TRANSACTIONS

—OF THE—

AMERICAN

FISH CULTURAL ASSOCIATION.

NINTH ANNUAL MEETING,

Held at the Directors' Rooms of the Fulton Market Fish-Mongers' Association, in the City of New York.

March 30th and 31st, 1880.

NEW YORK.

1880.

OFFICERS, 1880-81.

ROBERT B. ROOSEVELT, - - - PRESIDENT.
New York City.

GEO. SHEPARD PAGE, - - - VICE-PRESIDENT.
New York City.

EUGENE G. BLACKFORD, - - - TREASURER.
New York City.

BARNET PHILLIPS, - CORRESPONDING SECRETARY.
Brooklyn, N. Y.

JAMES ANNIN, JR., - - RECORDING SECRETARY.
Caledonia, N. Y.

EXECUTIVE COMMITTEE.

FRED. MATHER, - - - - *Newark, N. J.*

G. BROWNE GOODE, - - - *Washington, D. C.*

SAMUEL WILMOT, - - - *Ottawa, Ont.*

BENJAMIN WEST, - - - *New York City.*

THOMAS B. FERGUSON, - - - *Baltimore, Md.*

JAMES BENKARD, - - - *New York City.*

H. D. McGOVERN, - - - - *Brooklyn, N. Y.*

NINTH ANNUAL MEETING

—OF—

THE FISH CULTURAL ASSOCIATION.

TUESDAY, March 30th, 1880.

THE meeting was called to order in the Director's room of the Fulton Market Fish-Mongers' Association, in the City of New York, by the President, Hon. ROBERT B. ROOSEVELT, at 11.30 A. M., who made a short introductory address.

The minutes of the last meeting were read and approved.

The following gentlemen were proposed for membership and duly elected :

H. P. Dwight,
Erastus Wiman,
Wm. P. Raynor,
Theodore E. Leeds,
Robert J. Kimball,
W. C. Mathews,
Thos. D. Townsend,
J. W. Simonton
C. B. Reynolds,
T. B. Stewart,
H. C. Harris,
John Whipple,
Charles Mallory,
G. L. Feuardent,
Fred. Habershaw,
Wm. M. Habershaw,
John Foord,
C. Van Brunt,
A. G. Lawrence,
H. N. Munn,
H. W. Gray,
H. B. Hollins,
F. C. Lawrence,
H. J. Nicholas,
O. K. King,
W. L. Breese,
W. F. Wharton,
W. Post,
Isaac Townsend,
Henry F. Crosby,
Perry Belmont,
W. B. Hopson,
George Ricardo,
R. U. Sherman,
H. R. Worthington,
Sumner R. Stone,
Wm. M. Hudson,
Gilbert E. Jones,
Harris Bogert,
Alfred N. Lawrence,
Asa B. French.

The Corresponding Secretary, BARNET PHILLIPS, read the following paper, in memory of the late Professor JAMES WOOD MILNER.

The sad duty devolves on me of announcing to you the death of Professor James W. Milner, who, at Waukegon, Ill., on the last day of December, 1879, passed away from this world.

Many of you here must remember what interest Professor Milner took in our proceedings. Thoroughly grounded in all the scientific data, perfectly at home in the practical details of fish culture, there were no questions of an icthyological or other character we could put to him that he did not respond to it at once in a singular terse and clear manner. He had the power of stripping the husk off of matter, and presenting you the perfect grain. This society owes a great deal of its prosperity to the labors of this man. Many of its plans, and especially the widening of its scope—the effort to make it more than local, to extend its influence—were suggested by Professor Milner. If ever any one had his whole soul in the work, it was that man, whom death has now taken away from among us. His quick, nervous manner, his intensity, the power he possessed to make any question lucid, his easy method of explanation, we can hear no more. His place will be one, in this Association, not easily filled. Fully trusted by the Smithsonian Institution, he took charge of some of its most important missions, and there are here some present who can testify to the thoroughly conscientious manner in which his task was fulfilled. There are, in this world, many ways of doing one's duty. It was Mr. Milner's ambition to leave no stone unturned that might be an obstacle in the way of scientific progress. You have often heard that saying, that "if war has its heroes, so has science its martyrs." The repetition of this has perhaps become trite, but it is none the less true. It was as much overwork as anything else; an excess of zeal which, early in Milner's life, as late in his career, shortened in such an untimely way his days. Brimful of his work, I have seen myself how careless, how utterly indifferent, Mr. Milner was of his person in the prosecution of his labors. It was my good fortune to have been with Mr. Milner as his guest on more than one occasion when he was engaged in

his professional duties. I remember when on a cold night on Chesapeake Bay, when his men were out on the water taking the shad eggs, that a sudden storm arose. There was no danger to the numerous boats' crews, but the chances were that if his presence were wanting, that some millions less of eggs would be the result. Indifferent to the rain, I have seen him hurry from out his berth (it was in the floating hatching-house), and, but half clad, spring into the nearest boat, at midnight, and spend all that night until dawn, going from boat to boat, encouraging the men in their exertions. The United States wanted to have the rivers teeming with fish, and there was enthusiasm enough in Mr. Milner to think himself the instrument for thus furnishing food to millions, and he was perfectly willing to lay down his life for what other men would have been languidly indifferent about. I have myself frequently remonstrated with Mr. Milner as to what I deemed to be an unnecessary exposure, and had warned him of possible fatal results, but his reply was, I remember his words distinctly, "I do not think I fulfil my duty thoroughly, conscientiously, in any other way." This somewhat explains the character of the man. The last time I saw him was some two years ago at Gloucester, where he was busy arranging apparatus for hatching the cod. The novelty of this duty excited his enthusiasm, and quite possibly the cold he had taken some time before was augmented by the chill dampness of a New England fall.

I can but briefly describe this useful life. Mr. Milner was born in Kingston, Ont., January 11th, 1841, and came to Chicago when he was five years old. As a boy he was a hard student, and developed early in life a taste for natural history. He was but a lad when he travelled through Minnesota making collections. At the breaking out of the war he volunteered in an artillery company, and served with distinction to almost its close, having been noted for conspicuous courage and gallantry. After an honorable discharge, he obtained a position in the Chicago Post-office. Still retaining his love for natural history, he thoroughly filled his position, but, combining with it the study of his favorite topics, this double work became too much for him, and his health broke down.

Retiring from his postal duties, he made explorations in the

peat beds, and exumed the skeleton of a moose, which he supposed belonged to an extinct species. Having written to the Smithsonian Institution in regard to it—describing the remains of this creature—the singular terseness and scientific instinct displayed in his letters attracted the attention of the Smithsonian Institution. This led to Mr. Milner's services being engaged by the Smithsonian. He was first employed by Professor Baird, in 1872, to gather together the statistics of the fish of the Great Lakes. Shortly afterward he joined the United States Fish Commission in Washington, and was in their employ up to the day of his death. Successive publications of the Fish Commission fully attest Mr. Milner's work and services. In addition to this, he was in close communication all the time with the present distinguished Secretary of the Smithsonian in collecting general statistics, and arranged the literary material for fish propagation in the reports, of which he was most especially editor. Milner's work was wide and extended. At different times he planned various fish-hatching campaigns in North Carolina, Virginia, on the Potomac, on the Susquehanna, at Havre de Grace, and at Holyoke. He had under his charge the cod-hatching at Gloucester, in 1878. The Secretary of the Smithsonian writes in his honor: "He was very methodical in everything, and as keeper of that portion of the archives under his charge, was a notable example of industry, care and precision."

There is some information more than touching which I have received, descriptive of Milner's last days. He was so enthusiastic in his work, that he went beyond his strength. He believed that with such a mission as was his, that he was invulnerable to the attacks of malaria or overwork, under which so many of his friends had succumbed.

When advised by Professor Baird, in the summer of 1878, to seek his home and take a needful rest, he still lingered at Washington, perfecting his plans for the steamer *Fish Hawk*, which he never was to see afloat—which vessel was the great triumph of American fish culture, and was only called into commission last month. Coming at last home to his wife, he refused to be thought even ill. In a month he was again at his post at Gloucester, entirely forgetful of himself, absorbed as he was in his work. When

his task there was concluded he became so ill that he was forced to take to his bed. As soon as he could travel, he hurried on to Washington. Though confined to his room, still, with untiring energy, he conducted the business of the shipment and planting of the California salmon into Michigan waters, by means of the telegraph. His cough continuing, his physician ordered him at once to Aiken, S. C. But finding he could do no work there, but slightly improved in health, he went to Western Florida. Mrs. Milner having met him in New Orleans, she informs me that any idea of rest was even then the farthest from his mind. Florida might do him good, but that was secondary to the fact that he might conduct some work in Florida—there were collections to be made there. Mr. Milner remained in Florida until May, but was no better. It was with a terrible struggle that he then gave up the hope of future usefulness. I cannot imagine any more dread conflict than that which is sometimes waged between a man's active brain and his perishing body. It was in May that this devoted man went home to die. Life was gradually ebbing, but still the mental powers had lost nothing of their force. He could not bear to think that his work might stop with him for ever.

A bare chance of life was possible. It might be found in Colorado. Thither he went last September; still he refused mental rest, for life was to him as worth nothing save enhanced by work. He rallied for a while, but then became more physically feeble. The vitality in the man was immense. If he was too weak to write letters, he dictated them. When, in October, the doctors told him that his time was short, then his resignation was supreme. Even then he remembered many of his friends, members of this Association present here to-day, and wanted to send them his last word and greeting. He said—these are his very words: "I am dying without a feeling of ill-will toward any man;" "and could you (writes to me, Mrs. Milner) have seen his loving-kindness toward all who came under his notice, you could better understand the noble qualities, the untold goodness of this man."

Let us, then, respect the memory of James Wood Milner, who was not only of singular service to this world, but who was

honest, sincere, and endowed with many wonderful gifts. It is to the disinterested efforts of such a sterling man as was Professor Milner that we are beholden for the present position we enjoy, and though he be lost to us, I am hopeful that the memory of one of our leading officers will always be reverenced by the American Fish Cultural Association.

MR. BLACKFORD offered the following resolution:

Resolved, That the President appoint three members of this Association to prepare suitable memorials on the death of Professor Milner, a copy of which should be forwarded to Mrs. Milner.

THE PRESIDENT appointed as said committee MR. BLACKFORD, MR. PHILLIPS, and MR. GREEN.

THE PRESIDENT then read the following paper on Hybrids:

HYBRIDS.—Since the creation of the New York Fishing Commission, particular attention has been paid to crossing different breeds, and even species of fish, as we hoped that valuable results might be obtained from such interesting experiments. Curious as it may seem, these experiments have rarely been abortive, no matter how dissimilar the families, the eggs have been impregnated often to a large percentage, and have hatched. The following varieties have been crossed:

FEMALE.		MALE.
Salmon-trout	with	White-fish.
" "	"	Brook-trout.
Brook-trout	"	Fresh-water Herring.
" "	"	California Salmon.
" "	"	" Mountain-trout.
Shad	"	Striped Bass.
"	"	Herring.

Of these we have the young now at the hatching-house of the salmon-trout brook-trout; the brook-trout California salmon; and brook-trout California brook-trout.

It is observable of all hybrids that they are shy and wild; more so usually than either of their parents, and that in appearance they favor their larger parent. The cross between the brook-

trout and California salmon looks much more like the salmon than it does like the trout, being quite silvery on the sides and long and slim in shape, as you will see by this specimen which I have had preserved. There are some sixty of these now living, from eight to twelve inches long, and they are so shy that they can hardly be examined, and dart hither and thither when any one approaches the pond in which they are kept, in the utmost terror and uneasiness. The young of the salmon-trout and brook-trout have the square tail of the brook-trout, that of the salmon-trout being quite forked, and although they have no carmine specs, have smaller spots than the salmon-trout, and are quite stocky in shape. These bid fair to be a fine fish; those at the New York hatching-house being six or eight inches long on January, 1880.

The cross of the shad and herring was made in order to save the eggs of ripe shad when no ripe males were to be had. Although the male was an inferior fish, the cross was not expected to be an improvement over the mother, still such as it was, it was so much clear gain. There is in consequence a fish, although not the best kind of fish, where otherwise there would have been none. The young have thriven well, and we hear of their being caught on the rocky shallows of the Hudson river. They probably are not migratory, and can be taken with rod and line. It would seem from all accounts that they are quite numerous, and I give a letter from Mr. VAN WYCK, about them at the close of this article. The cross of the shad and striped-bass has never been heard from, so far as we can affirm positively. As some of these were hatched in the autumn of 1876, and quite a large number in the succeeding year, we hoped that some of them would have been taken full grown before this time. A reward was offered in 1879 for any specimens, but none were presented. The final outcome of this experiment is left entirely in the dark. Such care and pains were, however, taken when the impregnation was effected, to make sure that no germs of shad-milt were in the water that was used, or could by any possibility come in contact with the spawn, that there can be no doubt of the fact of the cross. Whether so odd a fish had the power of sustaining itself, obtaining its food, and holding its own in the struggle for

existence, is another question that the future has still to solve. This curious combination of the long-finned and soft-finned races of fish, varieties which are wholly separated in the scientist's classification, were undoubtedly hatched, but that they lived after the food-sac was absorbed, is at present undetermined. They may have perished like the two-headed monstrosities which are often born. In September, 1879, the young of the brook-trout and California salmon were seen to be maturing their eggs. This was the first time in the history of fish culture that hybrids gave evidence of breeding. It is asserted that among animals, mules are occasionally known to produce young, but this is a most unusual exception to a general rule. We had expected no more from the experiments in crossing varieties than the production of combinations which might be valuable in themselves, like the capons among fowls, or the mules among draught animals, but which must of necessity be purely ephemeral, and perishing with the lives of the individuals. But when these hybrid trout-salmon were opened and found to contain eggs quite large and well forward in maturity, it seemed possible that new species might be created and made permanent. The eggs were already larger than the mature eggs of the trout, although it was then early in the season, and seemed perfectly healthy. As time passed the parents were watched with care, and were soon seen to be going into the spawning-race. They apparently made all their preparations for spawning, began digging their nests, stayed about them, and proceeded in the regular way, except that they were never in pairs, but always single. This was not natural, and led to a careful examination of them individually. After examining some fifty out of the sixty, the conclusion was reached that they were all females, which eventually turned out to be the case. This was in the latter part of November, 1879. Some dozen male brook-trout were then placed among the hybrids, to see if they would induce the latter to spawn. Everything soon appeared favorable for this result, the trout paired with the trout-salmon, they entered the race-way together, and occupied themselves with parental duties, but no results were perceived. For some reason the spawn was not deposited. Then some of the fish were selected to be stripped

by hand, and were found to be ripe, but the eggs were all crusheed in passing from them. The vent of the ovaries or ovaduct was too small to allow the eggs, which had delicate shells, to pass. Attempts were then made to enlarge the vent, and some thousands of eggs were finally obtained in this way uninjured. To impregnate these the milt of the male trout was used. The parent fish were left in their pond and seemed to be uneasy. They are doubtless incommoded by the eggs which they cannot pass, and move about slowly with their heads towards the bottom, their tails upward, and their bodies at an angle to the surface. The eggs which it was hoped might be impregnated by hand, were retained until January 25th, 1880, when it was found they were unimpregnated and dead, and they were thrown away. No eggs have yet been deposited in the regular way, and hybrids have not yet hatched. But two most extraordinary facts have been ascertained: one, that the eggs may be too large for extrusion; this may only be the case when the father is the larger fish; and the other that the entire body of one hatching may belong to a single sex. It is said that the shad-herring hatched on the Hudson are all males. This may be the end of the perpetuating of new breeds of fish, or it may be only the beginning. It does not follow that every batch of a cross, especially when taken in different years, will be of the same sex, nor that the eggs will be too large when the male is the smaller variety. As was mentioned before, the hybrid takes most points from the larger parent, and may do so even in the size of the eggs, so that where the cross is reversed there may be no difficulty in their extrusion. It was hardly to be expected that so wonderful a discovery as the creation of a new species could be made without trouble, and we should rather be surprised at the success already achieved in hatching the young of the cross at all. The number of combinations possible is very large, and the pains and care expended on improving plants, vegetables, and land animals, may yet succeed with fish.

We have again this year crossed the eastern brook with the California mountain-trout, both ways, and have impregnated about eighty per cent of the eggs so used.

The following is the letter in reference to the young of the cross of the shad with the herring of the Hudson river:

Some few years since I heard the shad fishermen on the Hudson were taking a new variety of shad, called by them rebel shad, some calling them Seth Green shad; on investigating the matter I found at the shad-hatching station on the Hudson, in stripping the fish off-hand, sometimes the ripe male shad was not to be had in quantities to suit, and that in cases of this kind the small herring was sometimes substituted; hence the hybrid, or cross. These fish have all the characteristics of the adult shad, and average from one and a quarter to two pounds each. Having formerly heard so much on the subject of fly-fishing for shad at the Holyoke dam, I concluded to give them a trial in the Hudson, and had procured some of the Holyoke shad-flies, and tried for them long and faithfully for two seasons, without success; but about five years ago I was fishing for white perch, on a fine day in October, and was much surprised by taking about ten of these new shad. I was fishing on the bottom, and the fish would take the bait when the line was being rapidly hauled from the bottom; live bait was used (small shiner). I sent a couple of specimens to Seth Green, who pronounced them these herring-shad of about two years of age. I have taken them regularly since, every fall, with a light fly, or any dark fly will do; the season generally commences October 1st, and lasts about five weeks. The time to fish is at daybreak or sunset, and then you have to fish on the middle of the tide, half ebb or flood, it don't seem to make any difference; they begin to feed at half-tide and can't be caught on the surface at any other time. They present a beautiful sight when feeding, the water seems alive with them, darting and jumping everywhere; some of them jump a foot clean from the water. They feed on small shad about one and a half inches long. They feed from about twenty to twenty-five minutes, and then the "jig is up" till next tide. Twelve to fifteen is a good catch on a tide; they average about one pound each; the largest I have caught weighed 1⅞ pounds. It is no use fishing for them on a bright sunny day, as they will not bite. I have had a number of my friends go out with me fly-fishing for

these shad, and they all say it is the finest sport they ever had in fly-fishing. They are very gamey, make rapid runs, and will break from the water like a black bass.

P. A. M. VAN WYCK.

MR. GREEN then read the following paper:

When I speak so highly of the California mountain-trout, I do not wish to be understood that I have gone back on our speckled beauties; on the contrary, I think our brook-trout one of the handsomest and best fish in the world, and that we can have both kinds, and the mountain-trout will live in many streams that our trout will not live in.

For some time previous to this meeting I have been racking my brain to think of something on which to address you, and I find it a very difficult matter to think of anything to say that has not been said before. The fact of the matter is, that the American people, and especially the members of this Association, are getting so well educated on the subject of fish-culture, that I find that the ground has to be looked over very closely to discover a new idea to advance.

The New York State Fishery Commission being the first to introduce the California mountain-trout into eastern waters, I will give you our experience with them. We have at the New York State Hatchery 16,000 two-year olds, and 34,000 yearlings, the product from 500 spawn which we obtained in 1875. We find them a much more easy fish to raise than the eastern brook-trout, and they grow almost twice as fast. A brook-trout at three years old will weigh about one-half pound, and a California mountain-trout will weigh about one pound. For sporting purposes they are in my opinion superior to the brook-trout, being a much stronger fish and full of pluck, and in regard to their qualities as a table-fish they must necessarily be fine, as they inhabit pure-water streams and live upon the same food principally that brook-trout do. They are an excellent fish for the headwaters of our large rivers—the Hudson, Susquehanna, Delaware, etc. We have as yet been able to supply only a limited number to any of our waters, being anxious to preserve as

large a quantity as possible for breeders; but we have tried them enough to know that they will do well with us.

In the year 1878 we supplied a few thousand for the head-waters of the Genessee river for the sake of the experiment, and last season they were heard from to such an extent, and in such fine condition, that we are justified in the belief that but a small proportion of them perished, and that they had found the food suitable for them.

I received a letter from Mr. John Hyland, of Danesville, who caught a few for examination, saying that he had caught them in California many years ago, and found the same kind of food in them here that they lived upon in California. We also put 2,000 in Caledonia Spring creek, and I have no difficulty in catching twenty inside of an hour. They spawn in March and April, but this season we observed them at work in February, and took the first spawn February 23rd, which is about fifteen days earlier than we have ever taken it before. This is probably due to the change of climate and temperature of the water, and it is not improbable that when they become thoroughly acclimated they will commence spawning in the fall, as our brook-trout do. A female California mountain-trout produces, at five years old, about 1,500 eggs, and at this age some of them weigh as high 3 1-2 pounds.

We find them a very difficult fish to take the spawn from without injury, as they are so strong that it is almost impossible for one man to hold and strip them without damaging them. To overcome this we operate with them the same as with shad and other large fish: have one man hold them by the head, while another does the stripping. By so doing the fish is less liable to injury.

When their spawning season arrives, the males are very ferocious. The first season that we got them that they were old enough to spawn, I was somewhat troubled to know how they became bruised and cut so severely, but was not long in discovering the cause. I had holes cut in the coverings of the spawning-races, and by lying down and covering my head with an old coat, watched them, and saw the most furious battles I have ever witnessed with fish. A few received such injuries that they died,

and those that survived had the skin torn off so that the flesh was laid bare in many places. I subjected all the injured ones to a strong salt and water bath daily for some time, and succeeded in saving most of them. We have never before saved any other kind of fish that was injured half as badly. The scars can now be plainly seen upon them. Their spawn in size is between that of the brook-trout and salmon-trout, and hatches in Caledonia Spring creek water in about fifty days. The young are vigorous from the start, and by exercising good care and feeding them regularly, there is no difficulty in raising them.

Last season we procured from J. B. Campbell, McCloud river, Shasta county, Cal., Baird P. O., 7,000 McCloud river trout-spawn, 2,000 of which were dead on arrival. We have now on hand 4,742 yearlings in fine condition; they are equally as easy a fish to raise as the California mountain-trout, and resemble them closely in appearance.

This season we procured from R. Burgess & Sons, Bennington, Vt., 100,000 brook-trout spawn, for the purpose of mixing them with the brook-trout at the New York State Hatchery. My object in so doing is to see if the breed cannot be improved by putting trout together that have no relation to each other, as we know that constant inter-breeding of animals makes them inferior both in size and intellect.

I am anxious to improve fish in both these respects; and as I contend that fish have reasoning powers, I do not see why they cannot be improved upon on the point of intellect. If we can breed a trout that has sense enough to avoid the nets of the poachers on Long Island, I am under the impression that some clubs that I know of would be willing to give somebody a chromo.

We have been distributing fresh-water shrimp and other insects from Caledonia creek to many waters. There is no better food for trout than the fresh-water shrimp in which Caledonia creek abounds. They resemble the salt-water shrimp in shape, and grow to about three-fourths of an inch in length; they are great feeders; they carry their spawn under their tails, and hatch them in the same way that the lobster does. They impart a flavor to trout such as no other food gives.

Waters can be stocked with fish in proportion to the food they contain, and as much attention should be paid to stocking our waters with food as with fish, as it is impossible for fish to thrive unless they are supplied with the proper food. We have also stocked some waters with crawfish for food for the black bass. I have observed that bass thrive much better and are a finer table-fish in all waters containing this food, and would advise parties interested in waters containing black bass to examine them and see if they contain the crawfish, and if they do not to put them in. I can furnish the stock for any public waters in this state. They increase very fast. One or two thousand breeders would soon stock almost any waters. A cheap way to get them would be to set the boys to work in the vicinity of some streams containing them. Of course the nearer to the water you wish to stock the better; two or three boys, in the course of a few days would catch all that is necessary.

It is a wonder to me that more attention is not paid by farmers to raising frogs. There is scarcely a farm but has in some portion of it a soft springy or marshy spot which is not utilized in any way. If the farmer would dig out a place twenty or thirty feet square and from one to five feet deep, and build a tight board-fence around it about three feet high, and put in a hundred or so mature frogs, he could with little trouble raise all he wanted for his own table, and perhaps furnish a few for market, and if he learned to raise them on a large scale, could realize more than from regular agricultural pursuits. There is still a great deal to be learned in this direction, and whoever first learns to raise them successfully on a large scale, will be rich. I have given my experience with them in "Fish Hatching and Fish Catching, by Mr. Roosevelt and myself."

I have, in some articles that I have written, referred to the crawfish, or fresh-water crab. They are being sold in many of our markets, and have become one of the articles of food in this country. I will give a short sketch of my observations of their habits and how they can be raised. They are natives of very many waters nearly all over the United States, and can be raised easily if the pond is properly prepared. Dig a pond five or six feet deep, and have it cover a space equivalent to fifty feet

square, the sides sloping, and put a tight board-fence around the pond a few feet from the water, and nail a board across the top of each corner of the fence, to prevent the crawfish from climbing out at the corners, leaving room so that they can get out on the land, as they like to in the night, for when they wish to move they will travel a great ways during the night. If the soil is soft care should be taken to have the bottom of the pond and the sides clear to the fence lined with some kind of material that they cannot dig through, as they travel in the ground like a mole. Their skeletons and their holes can be seen all over the western prairies, miles from any water.

There should not be any other kind of animals or fish in the pond, as they have many enemies, of which I will mention a few: frogs, snakes, toads, lizards, owls, cranes, coons, musk-rats, mink, and many kinds of fish. The pond should have some earth and flat stones in the bottom, so that they can burrow in the earth or get under the stones. You can stock your pond by going to a stony brook and turning over the stones and slabs and catching the crawfish with your hands or a small scoop-net. A few hundred mature crawfish will bring you many thousand young the first year. They are great breeders; they carry their spawn under their tails until they hatch. They are also great scavengers; they will eat any kind of animal matter, or any formation between animal and vegetable. They mature in about three or four years.

I take pleasure in reading the following letter, as it gives actual results of fish-culture. I am constantly in receipt of letters from all parts of the state, showing the appreciation of the people of our labors:

FISH STOCKING.

WHAT IT HAS DONE FOR OTSEGO LAKE.

The following letter speaks for itself. It is from the beautiful village which was the home of James Fennimore Cooper, and refers to the lake which he has made famous for all time:

COOPERSTOWN, March 10, 1880.

MR. SETH GREEN:—Again I am happy to say that the 100,000 salmon-trout you sent us were successfully put into our lake (Otsego). And again I sincerely thank you for your personal attention to our order. We have but little trouble now in raising funds to pay the expense of getting fish. A few years ago it was different, but when you convince the people that restocking lakes, rivers, and streams again with fish is surely a success, there is little trouble in raising funds to pay expenses. I would like to have some one tell me in what way a person can invest a few dollars better to benefit the poor than to put in a lake suitable for them 100,000 trout. To show you, two men on our lake two weeks ago, both fishing in a little shanty, caught twenty-three trout that weighed over sixty pounds; one of them weighed eight pounds. At fifteen cents per pound, for which they sell readily, you have $4.50 for each man for his day's work. This is only one instance of the kind. Last June two men out of one boat caught forty-three trout that weighed eighty-four pounds, in one day. A little over a year ago myself and wife caught out of one boat in one day seventeen trout that weighed fifty-six pounds; one weighed six pounds and nine ounces, and my wife caught that. Now these are all facts I know to be so.

So again I would ask in what way the people of this country could invest money for the benefit of the poor that will do them more good than by restocking our waters with fish? Poor people, as a rule, are most all fishermen, and when they are out of work, or after their day's work is done, take their hook and line and in a short time catch a meal, although but a small amount is invested by them in fishing-tackle. My experience has been, give a boy a good strong cord and a good-sized hook to match, and a fifteen-foot beech-pole, and he will land you more fish with less trouble in a day than all the fancy tackle and fancy rod and expert fishermen can land in a week.

There is no danger of a famine in this country. We have in the village of Cooperstown a great many families that get the greatest part of their living from fishing, and so it is all over the country.

While travelling through the southern part of the state of

New York I found that the Susquehanna and Delaware rivers, and nearly all of the other rivers, have been restocked with black bass and such other fish as would live in rivers, and the people were perfectly delighted, all saying that they were catching large quantities of fish.

We have protected our lake from net-fishing for three years; two years have already passed and we find that all kinds of fish are increasing. The two hundred black bass we got of you five or six years ago have increased wonderfully, and also the rock-bass. I don't believe there is a lake in the state of New York where a man can have better sport in fishing than in Otsego lake. We shall always point with pride to such men as yourself, Hon. Horatio Seymour and R. B. Roosevelt, who have spent their lives in this great enterprise and made it a grand success.

I remain as ever your friend,

A. W. THAYER,

Fish Committee.

MR. SAMUEL WILMOT, of New Jersey, the oldest shad fisherman on the Hudson, being present, gave his views on the destruction of the shad in the river.

MR. HUGH D. MCGOVERN submitted a paper on the curious habits of eels:

Though there has been much said about the eel by eminent men, such as Professor J. J. Beard and our worthy President, Hon. R. B. Roosevelt, I cannot refrain from mentioning some facts which have come within the knowledge of our absent friend and associate, one of the editors of the *Chicago Field*, Mr. Fred. Mather, and myself.

On the 2nd day of June, 1879, I invited Mr. Mather to take a trip on Long Island, with a view to capturing a few trout which inhabit our island waters.

We took it leisurely, not being very successful, and walked along the banks of Spring Creek, a small stream in the township of Jamaica, which empties into Jamaica Bay. We continued along the creek until reaching the conduit of the Brooklyn

Water Works, where it passes under the conduit. On the south side a pool forms in which some boys were bathing. The stream contained many eels, the largest being about the size of a No. 4 needle.

The buttresses of the conduit-house have two square openings, or arches, through which the waters of the creek pass very rapidly, at no time reaching within twelve inches of the top of the opening. It was our wish to possess some of these small eels; one of the small boys, anticipating our wish and perhaps desirous of a reward, proposed to catch some for us. No sooner said than done. The boy at once procured a handful of damp moss from the upper portion of the opening, containing about ten young eels. We suspected that the boys had a vessel hanging in the aperture whence they had taken the eels, wherein they had placed them previous to our arrival. I proceeded to solve the mystery. Procuring a fence-rail that crossed the pool, I walked over and thrust my arm into the aperture expecting to find the vessel, but without success. I raked the top with my fingers, and drawing forth a handful of moss, discovered the eels. We both knew, when young eels are barred off by a rapid current or dam, they could climb a perpendicular wall when wet and covered with vegetation, but were unwilling to believe they would cling like a fly to the ceiling.

"Well," said my companion, "we can tell our story, and let others believe or disbelieve us as they please."

I can say that after this experience we are more skeptical concerning waters that are inaccessible to eels. I have seen them on land at night, in the wet grass, and in shaded places, taking advantage of inclines and crevices, and now squirming their way through a stream by clinging to vegetable matter on the sides of stones, but nothing like this has ever before come under my observation.

The next paper read was by MR. LIVINGSTON STONE, U. S. Assistant Fish Commissioner, on the Transportation of Fish:

One very peculiar and exceptional characteristic attends the transportation of living fishes, namely, that they must be pro-

vided during all the time of their separation from their natural habitat with an artificial atmosphere; and not simply this, but the atmosphere provided them must be constantly in process of creation. I need hardly say that this characteristic does not belong to the carrying of other creatures, birds, animals, insects, nephtes, or plants. Put a bird in a cage and set the cage in the express car of your train and nature will provide all the atmospheric conditions required. Secure an animal on the deck of a vessel, or shut him up in a cattle-car, and nature furnishes his lungs with air enough without any trouble or thought on your part. So with other creatures, until you come to fishes; then a radical change takes place in the requirements of the situation. Place half a dozen pound-trout in July in as many gallons of water, and put them aboard the train, and they will all be dead in ten minutes, if indeed they live to get on the train at all, unless you keep constantly at work over them creating the atmospheric conditions just mentioned as being indispensable to their existence; and it must not be forgotten that you must not only provide them at the outset with an artificial atmosphere, but you must keep creating it every moment as you go along, till they reach their journey's end. It is this peculiarity about the transportation of living fishes that makes it so laborious, so difficult, and often so unsuccessful. It is this that makes such care, such painstaking, such watchfulness necessary. For not a moment, day or night, can the water in the tanks be left to take care of itself, and if you are travelling with any considerable variety of species, hardly a moment can the temperature be left to itself. If, after days and nights perhaps of almost incessant labor, you are overcome with sleep, and unconsciously let the temperature pass the fatal limit, you wake to find your fishes dead beyond recovery, and all your past labor on them gone for nothing. Or, if in an unguarded hour, perhaps exhausted from labor and want of sleep, you let too great an interval pass without aerating the water, you find to your dismay that your fish that you have worked over so long and faithfully are hopelessly lost. Such is the painstaking and watchful character of the work of transporting living fishes, imposed upon it by this peculiar necessity of having a constantly renewed atmosphere artificially pro-

vided for them. This, however, is the discouraging side of the subject. There is another side to it which, on the other hand, is quite encouraging, and that is that if you provide properly for the fishes at the start, and do give them the care they need, you are almost certain to be rewarded by success. It is not a matter of vague uncertainty. It is a foregone conclusion that if you start right, and give the fishes the correct treatment *en route* they will go through alive. I wish to emphasize this point, because in the transportation of fish, as it has been with the raising of young trout and the shipping of ova, there seems to be a vague idea in the minds of many, I might say generally prevalent, that the fishes die without a cause, from chance perhaps, or necessity. There is no such thing possible. When we take a fish from a native habitat and put it into a tank to carry it somewhere, and it dies, it does not die by chance or necessity. We have killed the fish ourselves, either from ignorance of its needs or from not attending to its wants when known. Now if all those who travel with living fishes would always bear distinctly in mind this truism, which seems almost like a platitude, that every fish that dies on the journey dies from an adequate and definite cause, it would have a variety of good effects. It would help remove this vague notion that the dying of the fishes is a matter of chance, it would help clear the minds of fish culturists as to what the requirements of traveling with fishes are, and it would make them inquire more minutely into the causes of loss in transit, and endeavor more intelligently to remove these causes of loss before starting off with their precious loads. I go even farther than to say that no fish die in the course of their journey without a distinct cause, and state it as my confirmed opinion that in the care of cold-water fishes at least the cause of death can be removed, and that almost any species, if not every species of cold-water fish, including both inland and ocean varieties, can be transported successfully over long distances in tanks. I know this statement will be received with a great deal of skepticism, but I thoroughly believe it, and shall feel much surprised when the cold-water fish is discovered that cannot be taken a journey of several days and nights on the cars. To go back a little to what I was saying: when a fish dies in our travelling tanks, since

we know that it had good cause for dying, and particularly since we know that we are responsible for its death, we should go to work and discover what the cause is, and then remove it. If we do this, and continue to do it until we have eliminated all the causes of loss, what can there be, I should like to know, to prevent our fish from going through to their journey's end happily and triumphantly alive? Having stated in general the requirements of the successful transportation of living fishes, and having expressed the opinion that most if not all the cold-water varieties of fishes can be successfully transported, perhaps I cannot better employ the time which remains to me than by enumerating some of the causes of loss in travelling with fishes, and the first of these which I shall mention is,

(1.) Transporting fish at wrong seasons of the year. An inexperienced person would think at first that fish that could be carried at all could be carried at one season of the year as well as another. But this is far from the truth. There are many species of fish that can travel with the greatest impunity at one season of the year, when it is utterly impossible to move them at another. To take a very well-known illustration: a brook-trout (*salmo fontinalis*) caught in midsummer, when he is very fat and the water is warm, will sometimes give his captor great trouble to keep him alive at all, while every one knows that trout in midwinter, when they are lean and the water is very cold, can be carried any distance with very little trouble and perfect safety. Of the truth of our remark, the whitefish (*coregonus albus*) is an excellent illustration. In June, when he is fat and the water is warm, he will almost die in being taken from the net, but in winter when properly treated he gives his attendant no trouble. The same is true of many other species, though these two examples are sufficient to illustrate the principle, and it becomes obvious that great loss may result from carrying fishes at a wrong time of the year.

(2.) Another common cause of loss is in starting with uncleanly or unsuitable tanks. I could name many instances that have come to my knowledge where a valuable lot of fish have been lost by neglecting to clean the tanks they were carried in.

This stupid blunder hardly deserves to be mentioned, because no one nowadays ought to be guilty of making it; but it is closely allied to another which it is very easy for any one to slip into, namely, using a tank that has some injurious properties about it, after it has been thoroughly washed. As an illustration, I should consider a new oak-tank decidedly dangerous to carry ocean-fish in during a long journey. The oak-wood will impart some of its peculiar taste to the water it contains. Now in carrying fresh-water fishes through a country where the water can be frequently changed with safety, this may do no harm, but in taking a long journey with ocean-fish, when the water cannot be changed at all, and when the fish are shut up in this tannin-tainted water for perhaps a week, I should say it would be exceedingly dangerous. In this case the injurious agency becomes cumulative, and as it increases every day, certainly no one can say how soon it would become fatally poisonous. Unsuitable tanks, therefore, may often be a cause of loss.

(3.) Taking too many fish for the amount of water with them. This is too obvious a cause of loss to require much to be said on the subject, so I will simply remark that there is a limit beyond which fish can be so crowded that no amount of aeration and no reduction of the temperature will keep the water in a wholesome condition. Then, of course, some must die; but it is to be hoped that no one's desire to carry a great many fish in a small space will cause his ambition to run away with his judgment, or blunder into this stupid source of injury to his fishes.

(4.) Not providing for the necessities of the journey before starting This is a more excusable mistake to make, and one which even careful fish-culturists are liable sometimes to fall into. It is not likely to be made on short trips, or when travelling through a settled country; but on a long journey and in an unsettled region there is often great danger if all emergencies are not foreseen and provided for. Permit me to give two illustrations from my own experience. When we were about to cross the Rocky Mountains with shad, in 1873, I relied upon there being a stove in the express or baggage car, with the help of which we could keep the temperature of our cans beyond all

danger. There proved to be no stove in either car, and although it was almost July, it was snowing when we reached Bryan, in Wyoming Territory. The temperature of the shad-cans went down with frightful rapidity after nightfall, and the only way in which we could save our fishes was by heating some irons in the furnace of the engine, very much to the engineer's disgust, and with them warming some water in a tub. We placed the shad-cans in the warm water, and thus kept up the temperature at a safe point. In taking out the first aquarium-car, in 1873, I let my stock of ice run down to almost nothing on the evening that we were to cross the Detroit river. On reaching the river the conductor found that the train was so long that he must either leave our car or one of the sleepers. He ought to have left one of the sleepers, as the passengers could have kept alive well enough until morning; but the conductor thought differently, and concluded to leave us instead of the Pullman-car. It was a hot night. We had a whole car as full of fishes as it could safely be, and only three utterly wornout and exhausted men to take care of them. Our ice was soon gone, and before midnight the situation became decidedly alarming. It was made all the worse by everybody assuring us that there was no chance to get any ice before morning. But this would not do. It was very obvious that if we did not get ice before morning we should not need it at all for some of the fishes. After great exertions, and after waking up, if I remember rightly, seventeen railroad men in succession, I at last got an engine and a flat-bottomed car, and succeeded in getting some ice from the Windsor ice-house, a mile and a half distant from where we were finally deposited. The fish were saved, but it was a close call, and illustrates what danger there is when travelling with live fishes in not providing for every possible emergency.

(*a.*) Using a wrong transporting medium. It is true that water in some form is the only medium in which fish can be carried, but there is a variety of kinds of water to choose from, viz: fresh water, salt water, brackish water, muddy water, snow water (or snow-slush), pure water, and alkaline water and it is very important in carrying live fishes to choose the right kind.

For instance, striped-bass (*Roccus lineatus*), although an ocean-fish, will not carry well when young in ocean water. They will also soon die in fresh water, but in slightly brackish water they become nearly as manageable in confinement as their hardy cousins of fresh water, the black-bass (*Grystes nigricans*). The white-fish of the Great Lakes is an extremely delicate fish to handle in water simply, but in a thick slush, made of snow and water, he gives his attendant no trouble at all. Young eels, although a fresh water fish, are perfectly unmanageable when travelling in pure fresh water, and will die in four or five days, notwithstanding the utmost care and most diligent aeration of the water; but put them into a tub with a few inches of muddy water, two or three grass-sods for them to crawl out on, they will prove the toughest travellers of all fishes, and require no care at all. They can, without doubt, in this way be sent anywhere over this country with perfect safety. All of which goes to show that it is very essential to take the fish you travel with in the right kind of water.

(6.) Keeping the water at a wrong temperature is a very fruitful source of disaster in carrying live fishes. If I were asked to name what I thought was the most important of all considerations in travelling with fishes, I should say keeping the temperature of the water right. Air-breathing animals can sustain life through a very great change of temperature. Bears can live in a temperature ranging anywhere between 30 deg. below zero and 140 deg. above zero. Human beings can sustain a temperature in the sun of 130 deg., and when sufficiently clothed will endure the extreme cold of 50 deg. below zero; but I do not know of a fish that is not limited to a range of 50 deg. or less. Trout life is restricted to a range of temperature included between 30 deg. above zero and 75 deg. above zero. Shad do not possess a much greater range, and so with most if not all the fishes we are best acquainted with. Consequently the matter of temperature is a far more important consideration with water-animals than with land-animals. This is perhaps best exemplified in the carrying of the fish just mentioned, trout and young shad. The safe carriage of either fish for a week or so is re-

duced almost to certainty if the temperature limits are rigidly observed ; but the situation becomes exceedingly perilous if the water containing the shad gets very cold, or the water containing the trout becomes even moderately warm. Here I wish to mention, by way of a caution, a fact that I have only recently noticed, and that is that fishes not only increase the warmth of the water that they are carried in, but the warmer the water becomes the more their presence increases the warmth. For instance, in carrying any fish, if you let the temperature rise five degrees without checking it, it will rise the next five degrees much quicker, and the next five very much quicker still. If a tank of large trout stands at 4 deg., it shows no marked tendency to rise in temperature, but let the temperature go up to 65 deg., and it will go on to 70 deg. with surprising rapidity unless it is checked. This is natural enough, as the increased heat produces a corresponding increased rapidity in the breathing of the fish. This creates greater animal heat, which in turn shows itself immediately in its effects on the water. It is very well to bear this fact in mind when travelling with fishes, because if not aware of it, the temperature at which the fishes are kept will, if rising, sometimes rise beyond the fatal limit before the attendant is conscious of danger.

(7.) Irregular aeration of the water is a very common though a very thoughtless source of loss in transporting fishes. This is a fault which no experienced person ought to be guilty of, and yet I think it is not an uncommon one. *Regularity* in aerating the water is what is needed, and not an alternation between extreme zeal and reckless neglect, which is just as fatal to the fish as thoroughgoing neglect. For instance, if you are carrying a tank of trout at a temperature which requires aeration every fifteen minutes, of what avail is it to aerate the water every minute for forty-seven hours, if during the last hour you let them go uncared for? The effect is no less fatal than if you had not aerated the water at all. Yet the ignorance of this simple fact, which every fish-culturist really knows, has been the cause of many deaths to the unfortunate fish. The best way is to ascertain just how often the water in each tank needs aeration, and

then leaving a good margin for safety, of course aerate the water so often and no oftener. You then insure the lives of your fish and spare yourself unnecessary labor.

(8.) Changing water during the journey is a dangerous thing and is the snare that the beginner most easily and most often falls into. Except when travelling with young shad or other fish that require change of water for the food it contains, there is very little need of changing the water much during the journey, and as a general rule there is danger in doing so. The more any one travels with live fish the less he changes the water on them. This lesson was impressed upon me in my very earliest experience in fish-culture fourteen years ago, in attempting to bring live trout from Monadnock Lake to Charlestown, N. H. The original lake-water which I took them in would have carried them a week, but I changed it three times in going the first ten miles. The fourth time I changed it the water proved to be bad and killed every one of the trout within twelve miles of our starting point. I have no doubt most fish-culturists could relate a similar experience. At all events, I can say for myself, that now I change the water less and less every time I travel with fish. This course commends itself to reason. In changing the water the risk becomes cumulative. Suppose that there is but one chance in fifty of getting injurious water at such change. In changing twenty-five times there are twenty-five chances out of fifty, or an even chance of killing your fish. On the other hand you are sure the water you start with is good, and as long as you keep it so it will not hurt the fish. Now in a journey of almost any length, when you use ice, the melting of the ice together with the dripping of the water for aeration, is usually quite sufficient to keep the water in good condition. Ice is almost always safe to use for two reasons: ice-cutters do not get their ice from impure water, and then besides, the freezing of the water generally frees it from such impurities as there may be in it. But it is not the ice alone that keeps the water good, but the friction of the constant dripping of it back and forth freshens and purifies it like a running brook. Indeed, if you dip the water continuously in the fish-tank it becomes practically a run-

ning brook, and works off its impurities, and for this reason I wish to urgently recommend the use of the dipper in aerating the water. There is nothing like it. I have carried fish of all sizes short journeys and long journeys, hundreds of miles, and thousands of miles, and I have never seen any contrivance yet that could begin to take the place of the dipper. One reason of this undoubtedly is that the friction resulting from continually pouring the water back into the tanks, cleanses, purifies and invigorates it. You can aerate the water beautifully by forcing a quantity of finely-divided air through a pipe perforated at the end with pin-holes, but I would not give half as much for the water to carry fish in, as for the water that is dipped up and turned back with the dipper. We had an exemplification of this on the trip to California last spring with lobsters and other fishes. Not supposing that the lobsters could survive the long overland trip without change of water, I arranged to have one hundred gallons of Pacific Ocean water meet us at Winnemucca, Nevada. We started from Boston with three forty-gallon tanks of lobsters and a small reserve of about thirty gallons of ocean-water, only enough, by the way, to supply the waste in transit. On reaching Winnemucca the reserve was almost entirely exhausted, and the water in the tanks showed an increasing tendency to become foul, and we looked forward to the fresh ocean-water at Winnemucca with the avidity of thirsty travellers approaching a spring in the desert. Imagine our dismay and disheartenment when we found every drop of the Pacific-water spoiled and converted into the most sickening kind of bilge-water. But—and this is the point—by energetic and almost incessant dipping, night and day, for the rest of the journey, we restocked the water in the tanks and kept it comparatively sweet till we were enabled to gladden the hearts of the lobsters with the water dipped up fresh from the Pacific Ocean, just outside the Golden Gate; while I firmly believe that with an air-forcing apparatus we should have lost every lobster. To bring out more prominently the value of the friction-force created by dipping the water, I will say that during the overland trip last spring we lifted up about three feet above the surface of the water and poured back into the tanks 75,000 gallons of water, being equiv-

alent to 1,800,000 pounds of water falling a foot, producing a friction-force as effective as that of a good-sized running stream of water. I ought to add here that the lobsters did not get the benefit of the melting ice as the fresh-water fish did, it being of course impracticable to put ice in the lobster-tanks on account of its freshening the water, a result rapidly fatal to lobsters. In place of ice for cooling the ocean-water, I kept two immense freezers in constant operation on the ice-cream freezing principle, and by frequently exchanging the water between the tank and the freezers, succeeded with much difficulty and labor in keeping the water cold enough for safety. I have endeavored in the above remarks to call attention to some of the not too obvious dangers that one is liable to fall into in travelling with living fishes, and if some of my suggestions have seemed superfluous, I hope it will also be remembered that too much care cannot be exercised in transporting live fishes, and that infinite precaution as well as eternal vigilance is the price of success at our journey's end.

The Secretary, MR. PHILLIPS, then read the following paper from C. J. BOTTEMANNE, M. D., Superintendent of Fisheries for the Netherlands.

DO GRILSE SPAWN?

Of the entire lot of grilse that enter the Dutch rivers, about seventy-five per cent of them, I calculate, are males. All have full milt. By the middle of August the hook (which the male salmon has in spawning-time on the point of the lower jaw) is developing fast. The females are always in the minority, but in the first part of the season there are more than towards the latter part. All have spawn, and towards the end of October they are so far ripe that when one is lifted by the head the spawn is running out.

Another thing observed in Holland is, that when there has been a good grilse season one year, two years afterwards there is a good season of so-called summer-salmon, viz: salmon of 10 to 16 pounds. About two years later there is a good catch of winter-salmon, viz: of 22 pounds and upwards.

Often the next year shows already an increase in the catch of the summer-salmon.

SALMO QUINNAT IN HOLLAND.

The California salmon-eggs, which, through the kindness of Prof. Spencer F. Baird, were presented by the United States of North America to the Netherlands, arrived per the Rotterdam steamer *Schiedam*, on three of Mr. Frederick Mather's improved refriger-ating boxes, on November 7th, at Brouwershaven.

During the passage, which lasted seventeen days, they were kept in the ice-house, and cared for by the chief officer.

Next day I met the steamer at Hellevoetsluis, transported the eggs to the zoological gardens at Amsterdam, and had them a little after midnight on the trays in splendid condition. Although not a single egg was picked out on the passage, the loss in bad eggs was only about two per cent.

During the hatching process the loss was far less than last year, and amounted to about fifteen per cent.

December 21st the last egg was burst. The fry are doing exceedingly well, and there are very few of those Siamese-twins and crooked-backs among them. The loss in fry was in the first days, about forty per day, gradually diminishing, and is now at the highest eight per day, a very low figure compared with that of 1878, when it ran as high as twelve and fourteen hundred in the first days.

I expect that when the sac is absorbed the loss in fry will be less than one per cent.

Of last year's lot 5,000 fry were put in a small pond and left to themselves, only taking care there was no lack of water. They were put in in January, 1879, when the sac was very near gone. All the food they got were the water insects from the brook by which the pond was supplied, and a few crushed mussels (*mytilus edulis linne*), which were taken greedily. In the summer the wire-grating was carried away at the outlet and a good many escaped. In November last the pond was drained, and what was left consisted of about 1,478 nice pairs of different sizes, the largest measuring sixteen centimeters.

One peculiarity of the young of salmon *quinnat*, observed in

the ponds, is that they always swim in a school. As soon as they are disturbed you see a whirl, and there is not one more to be seen. By waiting only a short time one after another comes forth out of their place of refuge, and the school is formed again in no time.

Not so the young of the salmon *salar;* when they are a couple of inches long, they never congregate; are always single (on the look out), and stand with the head current-up, while the quinnat swim up and down the pond from one end to the other.

The pairs on hand will be put in the river Maas, near Venlo, as soon as the water opens, all being frozen up now, as I have singled out that river for my experiments, as having been for years almost destitute of salmon.

Last January I put in at the same place 51,000 fry, but as I did not hear anything of them, I intend to keep all the fry in ponds till next fall, and have them well fed with mussels, so as to have not quite so much cannibalism among them.

C. J. BOTTEMANNE, M. D.

THE PRESIDENT then announced the Annual Fish Dinner for Wednesday evening, at the Metropolitan Hotel.

The following letter was received and read by the Secretary.

SANDUSKY, March 25th, 1880.

Mr. ROOSEVELT, *President, and members of the Fish-Cultural Association:*

GENTLEMEN—As business compels me to stay here, and I therefore, am not able to be present at the meeting of the Association, I take the liberty to propose the following in regard to pound-net fishing.

1. Pound-net fishing ought to be regulated by Congress as it is in Canada.

2. The meshes of pound-nets should be enlarged to protect the young and ungrown fish by giving them a chance to slip through the meshes.

3. Every pound-net should pay a revenue of between five

and ten dollars, and receive license and a certain ground to fish on, which will prevent crowding each other.

4. One person shall not get license for more than six (6) pound-nets.

5. It shall not be allowed to fish more than six (6) pound-net on one string.

6. Inspectors should be appointed for each of the large lakes to enforce the above, license the nets, and make out the grounds for same.

7. The inspectors should be paid out of the above-mentioned revenue.

8. For the balance of the revenue, hatcheries for all kinds of fish should be opened all along the four large lakes.

Now, gentlemen, these propositions I make on a very careful study of the pound-net question, and I therefore respectfully ask you to consider the matter and take the necessary steps in regard to it, and I am convinced it will, if well managed, turn out profitable for everybody.

Very respectfully yours,

THEO. REINECKE,

Pound-net fisher.

The following telegraph from W. F. WHITCHER was then read:

OTTAWA, Ont., March 24th, 1880.

Fish-Culture Association, Fish-Mongers' Rooms, Fulton Street, New York.

Excuse long silence. Illness and business reason. Neither self nor Wilmot can attend meeting this year, which we much regret. Parliament sitting, and we are under orders to attend special committee. Present best wishes and official regards to all our friends.

W. F. WHITCHER.

The order of proceedings for the afternoon was then given by the Secretary, and the meeting adjourned for one hour.

AFTERNOON SESSION.

The meeting was called to order by the Vice-President, MR. GEO. SHEPARD PAGE, who announced that the nomination of officers for the ensuing year was now in order, and appointed as a nominating committee Dr. W. M. Hudson, Asa French, and Geo. Lamphear.

The report of the Treasurer was then read and accepted.

The following resolution was offered by MR. PHILLIPS:

Resolved, That in case members do not pay their fees and are delinquent for two years, they shall be notified by the Treasurer, and if the amount due is not then paid within a month, that they be, without further notice, dropped from the roll of membership.

The resolution was accepted.

MR. JAMES ANNIN, JR., gave a practical illustration of stripping eggs from live brook-trout, and impregnating them with milt obtained in the same way from the male. The fish were brought alive in cans from Mr. Annin's ponds at Caledonia, New York.

MR. HALLOCK then read a very interesting paper entitled "The Shore-Fisheries of Labrador."

The Canadian salt-water fisheries yield an annual revenue to the Dominion of about twelve millions of dollars, of which fully one-half is derived from the coast of Labrador.

Within the single district lying near the eastern extremity of Belle Isle Strait, and embracing only about fifty miles of coast line, the produce of the cod, salmon, and herring fishing, is valued at fully $5,000,000. A summer trip to this locality of busy, and by no means fragrant operations, is one of the most interesting that can be undertaken by the student, rambler, or curiosity hunter.

From Belle Isle to the Moravian Missions on the North Atlantic Coast, in lat. 56 deg., a stretch of nearly 600 miles, the fish-

ing interests are strung all along shore; the low-lying, barren rocks, the fleets of vessels in the little harbors, and the drifting icebergs, diversifying the otherwise forbidding landscape, divides the attention of the observer.

In 1860 this industry employed some 1,500 souls. Now, twenty years later, it includes 5,000 persons, a nearly quadruple increase; which is significant, not only from a commercial and financial standpoint, but encouraging as respects any apprehensions which may have existed as to the ultimate extinction of the fish and the failure of the fisheries.

In 1860 there were but few permanent residents. There were few men hardy enough to brave the rigors and isolation of a nine months' winter, and the constant deprivations which the absence of almost any kind of communication with the rest of the world entailed. Aside from the vessels of the fishing-fleets, their only visitors were occasional trading-schooners, which dropped in clandestinely to pick up furs and any chance merchantable commodities, in exchange for meagre assortments of indifferent goods at exorbitant prices. The arrival of an excursion party was an event long to be talked of and remembered.

Now, and especially since the establishment of an efficient Government Fishery Commission, there are regular supply ships, as well as a coast-guard steamer, which keep up frequent stated communication in the open season, and afford timely provision against distress during those months when the coast is hermetically locked and sealed. Under these improved conditions of existence, with their added comforts, and the assurance of relief when the fisheries fail and assistance is needed, a large permanent population has been invited, which must contribute very much to the development of the fisheries by furnishing those mechanical appliances which could not be profitably employed when they had to be transported annually to the fishing-grounds by the fishing-vessels themselves.

There are several varieties of cod, but this paper has only to do with the shore-fish of the East Atlantic. Their range is from Cape Cod to the Arctic seas. They generally strike into the Gulf of St. Lawrence in May; and the voyager bound to the "norrud," who has succeeded in working his vessel through the

Gut of Canso, and laid his course up George's Bay at that time of year, will perchance find a seafog making on a favoring wind, and as the foggy atmosphere grows dense and envelopes him, the warning blare of fish-horns sounds ominously through the murk; the lookout on the jib-boom discovers here and there a fishing-boat tending trawls, or possibly a schooner at anchor which his own craft has barely missed as she slips by with that gentle ripple under forefoot which indicates a vessel under easy way.

This is the first opening of the fishing season.

Trawls, or bull-tows, are common at the entrances to the gulf, but open boats of from twenty to twenty-five feet often go out full thirty miles to sea, where the chances of a catch are better, and there encounter storms which larger vessels could not weather. Trawls have been objected to as unnecessarily destructive to breeding-cod; but it having been ascertained that cod deposit their eggs in the high seas as well as off shore, it becomes a matter of little consequence whether the breeders are caught with trawls or the ordinary hook and line. Most of the north-shore fishermen, from Cape Gaspe to Newport, who carry on the banks as well as the inshore fishing, use trawls. Everywhere else the fish are caught with hook and line.

As the fishing season advances and May gives place to June, the great mass of the fishing-fleet have arrived upon the coast, and are strung all along from Whale Head, Mecattina, and Bloue Sablon, on the Gulf, through Belle Isle, to its eastern entrance, bearing eastward and northward. It is a glorious sight, and very much like a regatta, to see the white-winged craft, single, in braces, and in clusters, sometimes two hundred in all, wholly becalmed on a silent sea, or overhauling each other with a stiff breeze blowing from the westward.

But fish do not always make their appearance in June. There is no stipulation in the bargain as to when they shall strike in. If bait is absent, there will be no codfish; and the absence of bait depends very much upon the temperature of the water. If the ice remains late upon the coast, the caplin keep in deep water, where it is warmer. Besides, stormy weather keeps all

kinds of fish away from the coast, as they do not like being knocked about and battered on the rocks by the waves.

Fish are always more abundant in some localities than in others; their well-known voracity and the instinct of conservation causing them to prefer those spots where small fish, mollusks, sand-lances, and crustaceans, most abound. Their movements and migrations are also governed by other natural causes, such as suitability of certain places for reproduction, and these favorable conditions not only present themselves near the shore, but also upon the banks of the high seas, in both of which it has been indubitably ascertained that the cod breeds.

After their summer visit to the Gulf of St. Lawrence and certain localities off shore, the cod seek the northern seas and the profound depths adjacent to the Newfoundland Banks.

Cruising along shore in the busy midsummer, the rocks and the water everywhere appear animate with life. Grampuses, whales, and predatory porpoises patrol the coast in quest of food, rolling their huge bodies up to the surface, blowing off small jets of water, and surging into the incoming schools of fish. Sly seals forage among the salmon nets, poking their round bullet-heads above the water in all directions, take a momentary survey and then disappear.

It is the breeding season for wild-fowl, and the outlying cliffs swarm with gannets, murrs, auks, puffins, gulls, sea-pigeons, and nameless birds. The air above and around these islands is filled with myriads constantly hovering, and the whirr of their rapid circling flight sounds like the hum of a factory. To and from their feeding-grounds foraging parties constantly wing their pathless way; keen-eyed sentries patrol the topmost crags; scouting parties and videttes, ever on the alert, wheel and hover about each approaching vessel, screaming at the intrusion. Bunches of eiders and shell-drakes float upon the waves, take wing when disturbed, and skim away to places more secure.

In every little bight and bay fleets of vessels lie quietly at their moorings, with bait-seines triced up to the mast-heads to dry. Moss-thatched cabins are scattered all over the granite boulders on shore, as if stranded there by a receding flood. Rude fishing-stages cling to the rocks on every side, supported on piles, the

water beneath stirred by the splash of the constantly falling offal from the splitting-tables above. Fishermen in oil suits are pitchforking fish out of loaded boats up to the stands, and boats laden and empty constantly arrive from and depart to the fishing-grounds. Gaunt dogs stroll along the landwash in search of food, and uncouth sculpins, with mouths as wide as their shoulders, try and tussel with each other for choice bits of tempting offal drifting with the tide. On every available space upon the rocks codfish are spread out on "flakes" to dry, and myriads of delicate caplin are curling and curing in the sun. These choice little fish are much relished by the resident settlers, who always prepare and lay by a good stock for winter consumption. On a warm day the air is redolent with innumerable stenches of curing and decaying fish, and noisesome exhalations from huge vats of livers trying out for oil. The occupation is by no means savory, and he who has once watched the process for ever after eats his codfish-balls with some compunctions of stomach, knowing that they are seasoned with something besides salt.

Women as well as men take part in the business of dressing fish, and in the recesses of the moss-thatched hovels the voice of the maiden may often be heard singing gleefully as she heads and splits, while the unceasing splash of the offal dropping into the water beneath chimes in befitting unison. An expert will split six thousand fish per day, or head twice that number.

Every fishing-station comprises a large salting-room, or store, where the prepared fish are temporarily housed. This building is always conspicuous among the stages and lodging-shanties. The latter are constructed of spruce poles or studs, like the stages, generally boasting but a single apartment, which both sexes occupy in common, the only division being that imaginary one which excludes all objects outside the line of vision. Sunday in Labrador is always a day of rest. The mornings are generally spent by the Catholics in humble devotion and prayer, and the afternoons in ball and card playing, music, drinking, and dancing. Other denominations observe the day in like manner, save that the morning services are omitted.

Many of the fishing-vessels cure their fish on board. The outfit of each vessel includes a cargo of salt, a supply of lines

and hooks, bait-seines, several puncheons for oil, and from four to eight boats. The crew is either hired or they go on shares, the fare of fish in the latter case being divided among them, after deducting a one-twelfth for curing. Your experienced and initiated fisherman almost invariably goes on "sheers;" for if fish are to be caught, he can catch as fair a "jog" as any man. He is one of those knowing chaps who predict the weather by the moaning of the sea, or by the "loam" or "glim" in the air. He never mistakes a catspaw for a "skull" of fish "briching." His labor always gives zest to his toil, and when his hard day's task is done, he can punish his "whiggin" of grog and a full allowance of "jo-floggers," "lobscouse," and "doughboys," to say nothing of "duff" on Sundays.

It is customary for the seine-boats to go in quest of bait in the early evening; these carefully search the little coves and inlets, and creep along the shores, and when the ripple of a passing school is detected, the lookout ahead or astern gives due warning. Overboard goes the seine smoothly and noiselessly, and with a rapid circuit the bait is imprisoned and quickly secured. One cast is generally sufficient, for the caplin swarm in millions, swimming so densely that often a dip-net can be filled from a passing school. They keep near the shore to avoid their finny pursuers, and are left floundering on the rocks by every reflex wave. The cod often leap clear of the water in their pursuit, and at such times may be taken by the hook with scarcely three feet of line almost the instant it touches the water. The caplin has very much the appearance and size of a smelt.

Hand-fishing for cod is not the high art of angling. Rapidly, one after another, the fish come floundering over the sides of the boat, and are dexterously slatted off the hooks upon the crotch-irons provided for the purpose, when the hooks, as quickly baited, are tossed overboard again, to be seized the instant they sink below the surface. In time the hands not toughened to the business become sore and water-soaked and skin off, and the arms and shoulders grow painfully lame. The thick lines draw up buckets of water, which run down the sleeves despite the protection of an "ile sute." Most fishermen handle two

lines. But good luck does not always reward the patient toiler, and many a vessel has often returned home without a fare.

After the cod-fishing is over, come the mackerel and the herring. Herring are taken with seines; mackerel with both seine and hook; with the seine early in the season, and later with the hook.

The migrations of mackerel are very irregular, and cannot be depended on. They will visit certain localities one season, and then disappear for several years together. But they are always to be found in the vicinity of the Magdalen Islands, in the Gulf of St. Lawrence, which appears to be one of their favorite spawning-grounds.

The yield of the salmon-fishery of Labrador is about eighteen hundred barrels per year.

Halibut are found in great abundance along the whole north coast, but are seldom fished for except by American vessels. They generally sell in the States at from fifteen to twenty cents a pound, while in Canadian markets they are so little valued as to seldom realize more than $6 per barrel.

There is good trout-fishing all along the Labrador coast, and I have myself taken a great many heavy fish with fly in the months of June and July.

I do not know that I have communicated anything new to the gentlemen of this Association, many of whom must know far more than I do about my subject; but never having seen any descriptive paper published giving an inside view of the Labrador fisheries, excepting one written many years ago by myself, I thought I would venture to introduce the subject here. I trust my recital has proved interesting, if not new.

The Vice-President, MR. PAGE, read the following letters:

ROCHESTER, N. Y., Feb. 19, 1880.

FRIEND PHINNEY—Yours of the 17th is received. In regard to the land-locked salmon, the reason I gave my opinion that they would not do well in Otsego Lake is because in the waters they inhabit in Maine the lakes are fed by large streams flowing directly into them, into which they go up to cast their spawn,

and from what I have heard of them, this seems to be one of the greatest essentials to their welfare. It would do no harm to try the experiment, if we had the fish. I have been expecting some spawn of this variety, and if they come can undoubtedly send you a few thousand if you desire it.

The Ontario salmon do not take the baited hook like the salmon-trout; they are caught with the artificial fly when in rivers; never have heard of one being caught except with net in Lake Ontario.

Yours, SETH GREEN.

I should like to visit you very much and enjoy fishing with you in Otsego Lake, and may do so next summer if I get time.

S. G.

COOPERSTOWN, March 22, 1880.

MY DEAR SIR—Please read the enclosed, and after confering with the members of the Association on the 20th, let me know your joint opinion as to the probable success of the experiment alluded to in our lake. The fish were planted (say 4,000) in June, 1877. Our lake is the source of the Susquehanna river, and is mainly supplied by bottom springs. At the head of it are several good-sized brooks, one of them a mill-stream upon which a boat may be rowed for a quarter of a mile. These streams are, I presume, too small for salmon to run up. So, if Mr. Green is correct, we may fail. It is, at any rate, an interesting question. Are any similar cases recorded in which this fish, being *strictly land-locked*, has matured or propagated?

Can you give me Mr. Ricardo's address, and tell me how many smelt Mr. Hartson started with from New Jersey?

Yours truly, E. PHINNEY.

HON. E. G. BLACKFORD,
State Commissioner of Fish.

DR. W. M. HUDSON gave the experience of the Connecticut State Fish Commissioners with the land-locked salmon, and stated that whether they would spawn or not he was not as yet decided about.

Some discussion here followed on the spawning habits of the trout family, as "To whether they always run into the streams to spawn, or whether they did not deposit their eggs as frequently in lakes."

The discussion was entered into by Messrs. PAGE, HUDSON, HALLOCK, MCGOVERN, and ANNIN.

MR. PHILLIPS read a short paper or article on the importance of getting at the statistics or figures in the results of fish-culture.

A valuable statistical paper was then read, prepared by MR. GEO. LAMPHEAR, on the number of pounds of each variety of fish sold in Fulton Market during the last year, as compared with the year preceding.

This short paper was prepared at the request of Professor SPENCER F. BAIRD, and MR. LAMPHEAR had been at great pains and trouble to prepare it. Its object was to determine whether the catch of any particular fish had increased or decreased from year to year. Massachusetts and Connecticut require of their fishermen a sworn return of their catches. The requirement is still rather new, and the fishermen are not quite used to it, but they were getting into the way, and the returns were coming in in better shape every year.

SALES OF FISH IN FULTON MARKET.

	March 1, 1878, to March 1, 1879.	March 1, 1879, to March 1, 1880.	Increase.	Decrease.
Flounders	1,544,842	1,795,980	251,147	
Halibut	3,327,790	3,549,121	221,331	
Codfish	8,636,479	8,719,574	82,095	
Pollock	222,908	315,879	92,971	
Haddock	1,857,790	1,813,820		43,970
Frostfish	53,792	77,871	24,079	
Blackfish	188,981	199,530	10,549	
Spanish Mackerel	275,163	310,970	35,807	
Weakfish	510,022	801,017	290,995	
Kingfish	38,090	38,447	357	
Sheepshead	82,474	67,325		15,149
Porgies	2,198,780	2,388,863	190,083	
Sea Bass	446,695	255,688		191,007
Striped Bass	716,642	678,423		38,219
Bluefish	3,843,983	3,570,543		273,440
Smelts	1,560,541	1,589,268	28,727	
Salmon	436,623	394,220		42,403
Herring	942,145	1,052,891	110,746	
Eels	1,202,414	1,292,917	90,503	
Sturgeon	70,633	68 858		1,775
Black Bass	79,850	85,011	5,161	
Pickerel	508,131	744,566	136,435	
Yellow Pike	173,367	129,251		44,116
Siscoes	629,661	624,438		5,223
Whitefish	741,943	693,085		48,857
Brook Trout	6,522	8,139	1,617	
Salmon Trout	84,262	96,160	11,898	
Catfish	98,562	52,847		45,715
Small fresh water	506,719	446,411		60,308
Green Turtle	6,103	8,189	2,086	
Lobster	1,625,655	1,737,224	111,569	
Salt water fish	912,199	670,131		242,068
	33,529,960	34,276,666		
INCREASE, 1879–80.			646,700	
	COUNT.	FISH.		
Mackerel	2,317,763	3,827,324	1,509,561	
Shad	661,594	953,439	291,845	
				GALS.
Scollops	46,451	36,445		10,006

MR. BLACKFORD thought that a law should be passed so that all fishermen would be obliged to take out a license for each net put into the water, and be obliged to make returns or figures to the number of fish or pounds of fish caught by each and every net. In this way statistics could be obtained which would be of great benefit to the United States Fish Commission, and we could see whether fish were on the increase or not.

The thanks of the Association were offered MR. LAMPHEAR for his very carefully prepared statistics.

The meeting then adjourned until 11 A. M. the next day.

SECOND DAY'S PROCEEDINGS.

WEDNESDAY, March 31st, 1880.

THE meeting was called to order by the President, R. B. ROOSEVELT, who introduced Professor W. O. Atwater, of Wesleyan University, Middletown. Conn., who read a long and very interesting paper on the nutritive qualities and values of various kinds of fish, comparing them with the composition and valuation of animal foods, such as beef, mutton, pork, venison, etc.

The subject to which your attention is invited this morning is the study of the food values of some of our different sorts of fish, as shown by chemical analysis. The field of investigation is comparatively new, and, as respects American fishes, hitherto almost untrodden. It is, nevertheless, important.

At the instance of Professor Baird, Secretary of the Smithsonian Institution and United States Fish Commissioner, through whose interest in the matter an appropriation for the purpose has been secured, I have been engaged, with my assistants, for some time past in the analysis of samples of our more common food-fishes. From a preliminary report of this work, soon to appear, the following figures are taken. Before giving the results, however, permit me a few words by way of introduction.

Fish constitute one of our most valuable sources of nourishment. They live upon matter dissolved and suspended in the water, or found on the bottom of streams, lakes, and the ocean, and thus gather for us nutritive material, which without them would be inaccessible to man. And since cheap and wholesome food is fundamental to the material prosperity, culture, and even the morality of a people, it follows that fish-culture may be made an important factor of our national welfare.

I deem myself particularly fortunate in the opportunity of presenting this topic to an Association which has done, and is doing, so much to further the good cause of fish-culture.

THE TASTE FOR FISH,

I think, is a thing that advances with the advance of civilization. The taste of different civilizations vary, however. We read of Roman nobles who were in the way of paying twenty-five hundred sesterces (one hundred dollars) for a single lamprey, and twelve thousand and even twenty-five thousand sesterces for a six-pound mullet, and considered only the livers and gills of these fish fit to set before an emperor. We are told that they sent ships to foreign lands for fish; that they built reservoirs for breeding them at home; that they fed them with veal soaked in human blood, and even with the flesh of slaves sacrificed for the purpose. But this was part of an imperial shoddyism that would devote four hundred thousand sesterces to a single banquet, whose guests were content with gross cooking and grosser accompaniments if they could be regaled with peacocks' brains and singing birds' tongues.

The fish to please the taste of the members of this Association would be served with less splendor and more wholesome sauce. We of to-day ask for palatable and nutritious food, and, with the increasing culture of our palates and consequent call for variety, we demand more and more kinds, and larger and larger quantities of fish.

THE FLESH OF FISH.

The flesh of fish does not differ essentially from that of mam-

mals. To the epicure it is more dainty, while the poor man can purchase nutritive materials in dried and salt fish for only a fraction of their cost in ordinary meats.

In general, fish has somewhat more water and less solids than the beef, pork, mutton, and other common meats. Like the latter, the fatter it is the less water it contains. The amount of fat in the flesh of different species of fish, and in the same fish at different times, varies widely. Cod, bass, and bluefish, have usually but little fat, while the flesh of eels, shad, trout, and salmon, in their season, is very fat. With the leaner fish we use butter or oil to make up the deficiency of fat.

For the best apprehension of our subject, it will be well to devote a few minutes to

THE CHEMISTY OF FOODS.

We eat meat and fish, milk and bread, to build up our bodies, to repair their wastes, to supply heat to keep ourselves warm, and strength with which to work. This is the common way of putting it. Speaking as chemists and physiologists, we should say that our food supplies, besides mineral substances and water, albuminoids, carbohydrates and fats, whose functions are to be transformed into the tissues and fluids of the body, muscle and tendon, blood and bone, and by their consumption to produce heat and force. That we may fix more clearly in our minds the nature and functions of the food materials, allow me to call your attention to the table before you, in which I have tried to condense some of the more important facts respecting foods and nutrition:

NUTRIENTS OF FOODS.

ALBUMINOIDS, CARBOHYDRATES, AND FATS.

ALBUMINOIDS OR PROTEIN COMPOUNDS.

NITROGENOUS.

Contain *Carbon*, *Oxygen*, *Hydrogen*, and *Nitrogen*.

In Plants.—ALBUMEN; CASEIN; FIBRIN, e. g., in gluten of wheat.

In Animal Body.—ALBUMEN; e. g., in blood serum and white of eggs.

FIBRIN; e. g., in muscle (lean meat).

In Milk.—ALBUMEN; CASEIN (curd).

CARBOHYDRATES.

NON-NITROGENOUS.

Consist of *Carbon*, *Oxygen*, and *Hydrogen*.

In Plants.—SUGAR; STARCH; CELLULOSE (in woody fiber).

In Animal Body.—INOSITE (sugar).

In Milk.—MILK SUGAR.

FATS.

NON-NITROGENOUS.

Consist of *Carbon*, *Oxygen*, and *Hydrogen*.

In Plants.—VEGETABLE FATS and OILS; e. g., linseed oil, olive oil.

In Animal Body.—FATS; e. g., fat meat, tallow, lard, etc.

In Milk.—FAT (butter).

FUNCTIONS OF FOOD INGREDIENTS IN NUTRITION.

NUTRIENTS OF FOODS.		OFFICES IN BODY.
ALBUMINOIDS.	are transformed into	ALBUMINOIDS, e. g., in muscle, gristle, and casein of milk. FATS, e. g., fat meat and fat (butter) of milk. CARBOHYDRATES, e. g., milk sugar.
	Serve for FUEL.	
CARBOHYDRATES.	Serve chiefly for FUEL.	
FATS.	are transformed into	FATS; e. g., for meat and butter. CARBOHYDRATES, e. g., milk, sugar.
	Serve for FUEL.	

ALL contribute to the production of MUSCULAR FORCE (?).

This schedule seems somewhat complicated at first sight, as well it may when we consider the amount of painstaking and costly scientific investigation, some of whose main results it attempts to summarize.

If the time and place permitted I should be glad to tell you

something of the ways in which the facts, as far as we know them, have been found out; of the thousands of chemical analyses of vegetable and animal substances that constitute our foods and the tissues and fluids of our bodies; of the years and years of labor of many men that have been devoted to the experimental study of the ways in which the food is used, the body built up, and its tissues consumed again; of the wonderfully complicated and yet beautifully simple instruments and operations by whose aid the utmost ingenuity of science has sought to discover the subtle processes by which the transformations go on in the body and flesh and fat are stored and heat and force produced. Suffice it to say, that the research of the past fifteen years, especially, has taught us much of the fundamental principles of nutrition, though we are still in the dark as to many of the details, as the interrogation point after the last word in the schedule implies. So let us return to our subject—the nutrients of our foods and their functions in nutrition.

Leaving out of account the water and mineral substances which, though essential to nutrition, are not to our present purpose, we have three classes of nutrients in our foods—albuminoids, carbohydrates, and fats.

ALBUMINOIDS, PROTOPLASM.

A little short of a dozen years ago many earnest-minded people on both sides of the Atlantic were startled by an address from Professor Huxley, on "A Physical Basis of Life." This "formal basis of life," this soulless substance in which vital phenomena were centred, while vitality, as a force, was excluded, was protaplasm, a material containing "the four elements, carbon, hydrogen, oxygen, and nitrogen, in very complex union. . . . . To this complex combination the name protein has been applied, and if we use this term with such caution as may properly arise out of our comparative ignorance of the things for which it stands, it may be truly said that all protoplasm is protinaceous, or, as the white or albumen of an egg is one of the commonest examples of a nearly pure protein matter, we may say that all living matter is more or less albuminoid."

As the schedule indicates, we have albuminoids in plants, as in the gluten of wheat ; and in the animal body, as in the fibrinogen and fibrinoplastic substances of blood, in the fibrin of muscle, in egghalbumen (white of eggs), and in the casein (curd) of milk.

The albuminoids are the most important of the nutrients of foods. Not only do they share in the formation of the fatty tissues and in the supply of material for the production of animal heat and muscular power, thus performing all of the functions of the other food ingredients in the body, but they also have a work of their own in the building up of the nitrogenous tissues, muscles, tendons, cartilage, etc., in which none of the other ingredients can share.

THE CARBOHYDRATES,

of which we have familiar examples in sugar, starch, and cellulose, differ from the albuminoids in that they have no nitrogen. They have, according to the best experimental evidence, no share in the formation of nitrogenous tissues in the body. It is hardly probable that they are transferred into fats to any considerable extent ; their chief use seems to be to supply fuel for the production of animal heat, and very probably of muscular power. They are very important constituents of foods, but much less so than the albuminoids and fats. They occur in only minute proportion in meats, fish, and like animal foods. We are well acquainted with

THE FATS,

as they occur in vegetable fats and oils, like linseed and olive oils, in fat meat, tallow and lard, and in butter. The fats, like the carbohydrates, are destitute of nitrogen. The fats of the food we eat are stored in the body as fats, transformed into carbo-hydrates, and serve for fuel, but do not form nitrogenous tissue. They are more valuable than the carbo-hydrates, because they are richer in carbon and hydrogen, the elements which give value to fuel, and because they supply the body with fats.

The albuminoids are often spoken of as the "flesh formers," and the carbohydrates and fats as "respiratory" substances. It was formerly believed, too, that the albuminoids alone could be transformed into the nitrogenous tissues of the body, but later research has led to the views stated above. The functions supply any material for respiration and for production of muscular energy are in all probability shared by all the nutrients.

To resume briefly—asking your pardon for the repetition: the albuminoids, the nitrogenous constituents of foods (albumen, fibrin, etc.), which make the lean meat, the muscle, the connective tissues, skin, and so on, are the most important of the nutrients. Next in importance come the fats, and last, the carbohydrates—sugar, starch, and the like. One reason of the inferior position of the carbo-hydrates is the fact that they have no nitrogen. The albuminoids can do their own work and all the work of the carbo-hydrates and fats as well, while these latter can only do their own. With lean meat alone we might make a shift to get on for a good while, but with carbo-hydrates and fats alone we should speedily starve.

Now the flesh of fish, like other animal foods, consists mainly of albuminoids, but has more or less of fats, and contains very little of the carbohydrates. Vegetable foods, on the other hand, consist largely of carbohydrates, and contain less of the albuminoids and fats. Science and experience unite in testifying that a proper combination of all makes the most wholesome, as we know it gives the most agreeable, diet.

Let us, then, note some of the main facts concerning

THE CHEMICAL COMPOSITION OF FISH.

TABLE I.—Analysis of Fish. Ingredients of Flesh and of Whole or Dressed Fish as taken for Analysis.

KIND OF FISH AND PART TAKEN FOR ANALYSIS.	FLESH—EDIBLE PORTION.					WHOLE OR DRESSED FISH.					
			Ingredients of solids (Nutrients).				*Edible Portion.*				
	Water.	*Solids.*	*Albuminoids (Protein)*	*Fats.*	*Mineral matter.*	*Waste, bones, skin, entrails, etc.*	*Water.*	*Albuminoids.*	*Fats.*	*Mineral matter.*	*Total edible solids. Actual nutritive subs.*
1. Flounders—Entrails removed	82.85	17.15	15.24	.62	1 29	58.51	4.37	6.33	.26	.53	7.12
2. Halibut—Posterior portion of body	79 36	20.64	17.33	2.15	1.10	21.13	30.22	13.14	1.63	.88	15.65
3. Halibut—Section of body	69 26	30.74	19.08	10.61	1.15	11.59	61.23	16.86	9.29	1.03	27.18
4. Cod—Head and entrails removed	83.12	16.18	15.44	.28	1.26	35.40	53.63	9.97	.18	.82	10.97
5. Cod—Head and entrails removed	82.45	17.55	15 90	.40	1.24	31.63	56 38	10.86	.27	.86	11.99
6. Eels—Skin, head and entrails removed	70.44	29.56	18.66	9.80	1.00	23.99	53.60	14.33	7.43	.68	22.41
7. Alewives—Whole	75 70	21.30	18.90	3.94	1.46	50.45	37.51	9.37	1.95	.72	12.04
8. Shad—Whole (Hudson River, first of season)	69.34	30.66	18.59	10.77	1.30	51.58	33 58	8.99	5.22	.63	14.84
9. Shad—Whole (Connecticut River, first of season)	64 53	35.47	19.80	14.25	1.42	47.37	33.95	10.42	7.48	.78	18.68
10 Striped bass—Whole (Connecticut River)	78.66	21.34	18.86	1.56	.92	57.75	33.23	7.97	.66	39	9.62
11. Striped bass—Entrails, head, skin, etc., removed	79 61	20.39	16.32	2.70	1.37	57.49	33.84	6.94	1.15	.58	8.67
12. Mackerel—Whole	77.82	22.18	19.05	2.18	.95	39.18	47.32	11 61	1.32	.57	13.50
13. Mackerel—Whole	74.23	25.77	17.51	7.02	1.24	54.28	33.98	8.01	3.21	.57	11.79
14. Bluefish—Entrails removed	78.15	21.85	19.33	1.25	1.27	49.66	39.34	9.37	.63	.64	11.00
15. Salmon—Entrails removed (Maine)	66.41	33.59	19.72	12.71	1.10	23.61	50.75	15.06	9.75	.83	25.64
16. Porgie—Whole	79.69	20.31	17.45	1.46	1.40	61.66	30.55	6.69	.56	.54	7.79
17. Haddock—Entrails removed	80.63	19.37	18.03	.18	1.16	52.73	37.32	8.34	.08	.53	8.95
18. Lake trout—Entrails, head, skin, etc., removed	68.69	31.31	17 70	12.26	1.35	56.69	29.75	7.67	5.30	.59	13.56
19. Brook trout—Entrails, head, skin, etc., removed	75.70	24.30	19.92	3.02	1.36	53.05	35.54	9.35	1.42	.64	11 41
20. Whitefish—Entrails, head, skin, etc., removed	69 59	30.41	21.66	7.14	1.61	54.23	31.85	9.92	3.26	.74	13.92
21. Red snapper—Entrails, head, skin, etc., removed	75.45	21.55	22.40	.67	1.48	60.40	29.88	8.87	.26	.59	9.72

Table I. herewith gives the results of a number of analyses as samples of fish, some supplied through the courtesy of Mr. E. G. Blackford, of your Association, and some purchased at the fish-markets in Middletown, Conn., where the analyses were made. Some of the samples were entire fish, others had been dressed. All were taken as they are ordinarily sold in the markets. Each sample on its receipt at the laboratory was weighed, then the flesh (the edible portion) was separated as carefully as practicable from the skin, bones, entrails, etc., weighed and prepared for analysis.

The figures in the table show, first, the composition of the flesh (the edible portion), freed from skin, bones, entrails, etc.; and second, the calculated composition of the whole fish, that is, of the whole sample as received, including, in some cases, the entire fish, and in others, the dressed fish.

Taking the flesh (the edible portion), one of the first points that strikes us in looking down the rather cumbrous columns of figures is the difference in the amounts of water in the different samples.

In one hundred pounds of flesh of cod we have eighty-three of water, and only seventeen of solids; while the flesh of the salmon contains only sixty-six and one-half per cent. of water, and thirty-three and one-half per cent. of solids. That is to say, about one-sixth of the flesh of cod and one-third of that of salmon consisted of solids, actual nutritive substances, the rest being water. The figures for some of the samples are:

IN FLESH OF—	WATER, PER CENT.	SOLIDS, PER CENT.
Flounder	82.8	17.2
Cod	83.1	16.9
Cod	82.4	17.8
Striped bass	78.7	21.3
Striped bass	79.6	20.4
Blue fish	78.1	21.8
Halibut (lean)	79.4	20.6
Halibut (fat)	69.3	30.7
Mackerel	77.8	22.2
Mackerel	74.2	23.8
Shad	69.3	30.7
Shad	64.5	35.5
Eels (salt-water)	70.4	29.6
Whitefish	69.6	30.4
Brook-trout	75.7	24.3
Lake-trout	68.7	37.3
Salmon	66.4	33.6

A good quality of beef, lean meat, free from bone, contains

about 75 per cent. water and 25 per cent. solids, while the fat beef may have as low as 55 per cent. of water. The fish are on the whole rather more watery than beef. Still the difference is not very great.

One of the samples, I confess, has disappointed me. With an enthusiastic sportman's appreciation of both the game qualities and the flavor of the speckled trout, I had looked for a higher per centage of solids in the flesh of that most respected fish. The sample stands well, to be sure, but not at the top of the list. But I take consolation in the fact that this is only a single analysis, and perhaps future results will show that it is below the average. The sample was a cultivated trout, and until we are assured to the contrary, we can assume that in his native streams he would have as solid flesh as his only superior in the sportsman's eyes, the salmon.

If now we consider not simply the flesh, the edible portion, but whole sample, as sold in the markets, and consisting of either the entire fish, or of that which is left after it is dressed, we have, of course, different figures, just as the per centage of edible solids in a roast of beef would be less than in the meat without the bone.

Looking down the last column of Table we find in the samples as received for analysis, after removal of bones, skin, and other work, including the water of the flesh, there would remain the following percentages of actually nutritive materials.

Flounders, 7.1.	Cod, 10.5.	Mackerel, 11.4.
Halibut (lean), 15.6.	Halibut (fatter), 27.2.	Shad, 14.8.
Shad, 18.7.	Lake-trout, 13.6.	Salmon, 25.6.

I ought to say that these figures are based upon our separations in the labaratory of the fresh, uncooked fish. It is not as easy to get the flesh off clean from the bones in this way, as it is after the fish has been cooked. So in the very bony fish more of the flesh went to waste than would be the case at the table in an economical household. Such fish, therefore, appear at somewhat of a disadvantage in the figures above. I should add that many of the details of the analyses, such as the per centage of so-called "extractive matters," albumen, gelatine, phosphorus,

sulphur, and other ingredients are omitted from the table. Some of them, however, are very important. We all know what a useful article of commerce is "Liebig's Meat Extract," which is prepared from the flesh of cattle slaughtered in South America and Texas. Fish can furnish an extract of equal value in every way. There is a fortune for somebody, I mistrust, in the extract from menhaden.

Leaving for the present the further examination of the table, allow me a few words concerning

THE NUTRITIVE VALUES OF FOODS.

This subject has of late begun to attract very general attention. The chemico-physiological research of the past two decades has brought us where we can judge with a considerable degree of accuracy, from the chemical composition of a food material, what is its value as compared with other foods for nourishment. The bulk of the best late investigation of this subject has been made in Germany, where chemists and physiologists have already got so far as to feel themselves warranted in computing the nutritive values of foods and arranging them in tables which are coming into popular use.

From one by Dr. König, who has given more attention to this especial subject than anybody else, I cite a number of analyses and valuations of meat, milk, etc., and add corresponding computations for some of the samples of fish reported above. The analyses of cured fish, however, are from Dr. König, our work having extended, as yet, only to fresh fish.

The valuations are based upon the amounts of albuminoids, carbohydrates, and fats in the several kinds of foods.

TABLE II.

COMPOSITION AND VALUATION OF ANIMAL FOODS. (Flesh free from bone.)	INGREDIENTS. Water.	Albuminoids (Protein.)	Fats.	Extractive matters.	Mineral ingredients.	Nutritive valuation compared with medium beef=100.
MEAT.						
Beef, lean	76.71	20.61	1.50	.....	1.18	91.3
Beef, medium	72.25	21.39	5.19	.....	1.17	100.0
Beef, fat	54.76	16.93	27.23	.....	1.08	112.0
Veal, fat	72.31	18.88	7.41	.07	1.33	92.4
Mutton, medium	75.99	18.11	5.77	.....	1.33	86.6
Pork, fat	47.40	14.54	37.34	.....	.72	116.0
Smoked beef	47.68	27.10	15.35	.....	10.59	146.0
Smoked ham	27.98	23.97	36.48	1.50	10.07	157.0
GAME, FOWL, ETC.						
Venison	75.76	19.77	1.92	1.42	1.13	88.8
Hen	70.06	18.49	9.34	1.20	.91	93.9
Duck	70.82	22.65	3.11	2.33	1.09	104.0
MILK, EGGS, ETC.						
Cow's milk	87.41	3.41	3.66	4.82	.70	23.8
Cow's milk, skimmed	90.63	3.06	.79	4.77	.75	18.5
Cow's milk, cream	66.41	3.70	25.72	3.54	.63	56.1
Butter	14.14	.86	83.11	.70	1.09	124.0
Cheese, skimmed milk	48.02	32.65	8.41	6.80	4.12	159.0
Cheese, fat	46.82	27.62	20.54	1.97	3.05	151.0
Cheese, very fat	35.75	27.16	30.43	2.53	4.13	163.0
Hen's eggs	73.67	12.55	12.11	.55	1.12	72.2
FRESH FISH.						
Flounder	82.85	15.24	.62	.....	1.29	65.0
Halibut	74.31	18.20	6.38	.....	1.12	88.0
Cod	82.78	15.67	.34	.....	1.25	68.0
Eels	70.44	18.66	9.80	.....	1.00	95.0
Shad	66.93	19.19	12.51	.....	1.36	99.0
Striped bass	79.13	17.59	2.13	.....	1.14	79.0
Mackerel	76.02	18.28	4.60	.....	1.09	86.0
Bluefish	78.15	19.33	1.25	.....	1.27	85.0
Salmon	66.41	19.72	12.71	.....	1.10	104.0
Haddock	80.63	18.03	.18	.....	1.16	78.0
Lake trout	68.69	17.70	12.26	.....	1.35	94.0
Brook trout	75.70	19.92	3.02	.....	1.36	91.0
Whitefish	69.59	21.66	7.14	.....	1.61	103.0
Red snapper	75.45	22.40	.67	.....	1.48	97.0
CURED FISH.						
Salt mackerel	48.43	20.82	14.40	.38	16.27	111.0
Dried cod	16.16	78.91	.78	2.59	1.56	346.0
Smoked herring	69.49	21.12	8.51	.....	1.24	104.0

This table will help us to a very fair idea of the comparative composition of some of our more common animal foods. The percentages refer to the fresh substance, except when especially stated as "dried," "smoked," etc. In the meats and fish the bones are excluded, the calculations referring only to the edible portions. The "extractive matters" are essentially the carbohydrates, which in the fish are of little moment.

Looking down the first column we see that while medium beef contains 72 per cent. of water, milk contains 87⅛ per cent. Roughly speaking, beefsteak is about three-fourths, and milk seven-eights, water. A pound of beefsteak would thus contain four ounces of solids, and, if we assume a pint of milk to weigh a pound, a quart would contain four ounces of solids also; that is, a pound of steak and a quart of milk contain about the same weight of actual nutrients. But we know that for ordinary use the pound of beefsteak is worth more for food than the quart of milk. The reason is simple. The solids of the lean steak are nearly all albuminoid, while those of the milk consist largely of fats and of milk sugar, a carbohydrate.

The figures in the table are, I think, worth looking through with some care. Remembering that those for meat and fish apply to only the edible portion, let me call your attention first to the varying proportions of albuminoids and fats in the second and third columns. On the whole you will notice that the fish average about the same percentages of albuminoids as the meats, but have rather less fats.

RELATIVE NUTRITIVE VALUES OF THE ANIMAL FOODS.

The figures in the last column are intended to show how the foods compare in nutritive valve, "medium beef" being taken as the standard. They are computed by ascribing certain values to the albuminoids and fats, and taking the sum in each case for the value of that particular food. The ratio here adopted, which assumes one pound of albuminoids to be equal to three pounds of fats, is that assumed by prominent German chemists. Taking medium beef at 100, the same weight of milk comes to 23.8; butter, 124; mutton (medium), 86.6; fat pork, 116; smoked beef,

146, and so on. The different samples of fish run from flounders, 65 ; cod, 68 ; shad, 99 ; whitefish, 103, to salmon, 104, while dried cod leads the list at 346.

These figures differ widely from the market values. But we pay for our foods according, not to their value for nourishing our bodies, but to their agreeableness to our palates.

CHEAP VERSUS DEAR FOOD.

Taking the samples of fish at their retail prices in the Middletown markets, the total edible solids in striped bass came to about $2.30 per pound, while in the Connecticut river salmon, whose price—thanks to our Fish Commission—was very low, we bought nutritive material at forty-four cents per pound. The cost of the nutritive material in one sample of halibut was fifty-seven cents, and in the other $1.45 per pound, though both were bought in the same place at the same price, fifteen cents per pound, gross weight.

It makes very little difference to a man with five thousand dollars a year whether he pays twenty-five cents or five dollars a pound for the albuminoids of his food, but it does make a difference to the housewife whose family must live on five hundred dollars a year. And a little definite knowledge of this sort will be of material help to her in furnishing her table economically.

The cook-books and newspapers have occasionally something to say upon these points, but their statements are apt to be as vague and wild as in the lack of authoritative information they might be expected to be.

Of course the nutritive valuations above given are only approximate, since they are made with very imperfect knowledge of either the digestibility of the foods or the influence of palatibility and other factors upon their nutritive value, and also because they are based upon very few analyses. But it is certain that we need to know more about these things, and that such investigations as I have been telling you about may help us toward that knowledge.

Before closing I ought perhaps to refer briefly to the very

widespread but unfounded notion that fish is particularly valuable for brain-food because of its large contents of phosphorus. Suffice it to say that there is no evidence as yet (though we hope to have more data before long) to prove that the flesh of fish is especially richer in phosphorus than other meats, and even if it were so, there is no proof that it would be on that account more valuable for brain-food. The questions of the nourishment of the brain and the sources of intellectual energy are too abstruse for speedy solution in the present condition of our knowledge.

In conclusion I have to say that I should be very sorry to be understood as implying that the facts I have given you exhaust or even begin to cover the subject we have been considering. They are only the very feeble and imperfect beginnings of a kind of investigation which, if sufficiently encouraged and rightly carried on, may hereafter bring knowledge of the greatest value. And let me beg you not to forget that while scientific research does so much to promote our material welfare, its highest value is in what it does for the culture of our minds.

The committee on nominations (DR. HUDSON, chairman) reported that the committee thought the re-nomination of the present officers as good a one as they could make; who were thereupon duly elected. An alteration was made in the Executive Committee, Mr. James Benkard, of New York, being elected in place of Benjamin L. Hewitt; Mr. McGovern, of Brooklyn, in place of Dr. Theodore Gill.

The Secretary, Mr. B. PHILLIPS, in behalf of the officers, returned thanks for the compliment, and said he hoped that they would be able to make arrangements for as interesting a meeting in 1881 as the present one had been.

A vote of thanks was passed by the Association to both Professor ATWATER and DR. BROOKS for their very valuable and interesting contributions.

MR. GEORGE S. PAGE then presented a paper entitled Black Bass Planting—results of their introduction into Maine waters.

Notwithstanding the diffusion of information concerning the results of restocking depleted rivers with salmon and shad; ponds, lakes, and streams, with bass, and brooks with trout, through the medium of the now widely circulated *Forest and Stream*, Chicago *Field*, and *Sea World*, and the Reports of the State and United States Fish Commissioners, the general public still profess great ignorance upon the subject. The press of the country, with few exceptions, fail to promulgate pertinent facts, and the legislatures of most of the states refuse to appropriate other than paltry sums in aid of this important interest.

The chief object of the American Fish Cultural Association is to educate public sentiment by the presentation, annually, of actual results experienced in stocking public waters with food-fish.

Of late the metropolitan press is well represented at our meetings. Liberal space in their thronged columns is given to our deliberations. The papers read are copiously quoted. Editorials are written commendatory of our labors. The Associated Press agents telegraph a synopsis of our proceedings to all parts of the land. The secular and religious press, east, west, north, and south, copy to a greater or less extent from the journals of the metropolis. Surely, in the near future the people will become informed of the really remarkable progress that is being made in the theory and practice of fish-culture, and their representatives in the state and national councils will make liberal appropriations to more rapidly advance the coming day when the most poverty-stricken citizen can procure an abundance of cheap, fresh, preserved, or salted fish-food.

It is a fact well-known to those who have been identified with this comparatively new science that many of the most successful efforts in restocking exhausted waters have been due to private enterprise.

Monuments are erected to military heroes and notable statesmen. Surely the praiseworthy act of the unknown engineer of the Baltimore and Ohio Railroad, who transported in the water-tank of his engine a score of black bass from the waters of the Ohio to the rapids of the Potomac, over twenty years ago, is equally deserving. Look at the results of that philanthropic

seed-sowing. The markets of Washington, Baltimore, Richmond, and other cities, are supplied with the numerous progeny of those few fishes. The members of several angling-clubs find health and recreation in the pursuit of these game-fish. The dealers in fishing-tackle secure greatly increased business from the demand for rods, lines, and flies, especially adapted for their capture.

But the good deed was repeated by some other unknown benefactor of his race. Bass from the Potomac were transported to the Susquehanna and Delaware. They have increased with great rapidity, and the markets of nearly every town and city of the great states of Pennsylvania and New Jersey are abundantly supplied.

It will be admitted by all who are familiar with the recent great popularity of Greenwood Lake as a summer resort, that the chief attraction is found in the black-bass fishing. Thousands of dollars are annually expended there, which but for these fish would flow in other directions.

But I desire to put on record the history of the introduction of black bass into the state of Maine. From the year 1860, in company with friends from other states, I had annually taken large numbers of the famous Rangeley trout, a goodly weight of which were transported out of the state of Maine, to become the witnesses of what Maine alone produced, and to serve as advertisements in drawing others to that region. In 1867 I brought to New York forty-three Rangeley trout, weighing from two to ten pounds, averaging five pounds each ; the two largest, male and female, respectively weighed ten and eight and a quarter pounds, were alive.

The ten-pound trout is now exposed in a glass case at Mr. Blackford's, in Fulton Market.

In 1868 I brought home in the same car thirty-three trout, from one and a half to two pounds each.

These experiences determined me to attempt to transport black bass to the Pine Tree State. Certainly some return in *fish kind* was due.

The following summer, accompanied by four friends, we took

the "Mary Powell," for Newburg, by invitation of Walter Brown, Esq., to fish his private pond for black bass. At daybreak we fairly surrounded the miniature lake, scarcely a quarter acre in extent; indeed we could readily cover the centre four feet of water with our flies. But the bass were there, and this was our first introduction to them. It is needless to say that we were highly gratified by their evident pleasure in making our acquaintance. So eager were they to meet us that some went whizzing by our ears and lodged in the long damp grass a hundred feet from their natural home. By six o'clock we had thirty-five sprightly bass, from a half pound to one pound each, in the car A team in waiting took them to the "Mary Powell" by seven A. M. At ten A. M. they were on the Fall River pier, with the Croton hose turned on. At five P. M. I took them in charge. One of the deck-hands gave them fresh air occasionally by the aid of an air-pump attached to the car. At seven A. M. the next day we reached Boston, and an express wagon conveyed them to the Eastern Railroad, the train leaving at eight A. M. They required much less attention than brook-trout. Aeration once an hour, and an occasional bucket of water, sufficed to keep them right-side up.

At three P. M. the train arrived at Monmouth, Maine, the station adjoining Crochnewaga Pond, four miles long, and sixteen bass were liberated here. At Winthrop, the next station, the car was taken to the famous Cobbossecontee Pond, one of a chain of ponds, or rather lakes, twenty miles in extent. The rest of the fish were deposited here, all in good condition. They did not move off at first, but seemed to be examining the immediate surroundings of their new home, five hundred miles from Newburg. One by one they slowly swam off into deep water, and I returned my fish-car to the steam-car, mentally congratulating myself that at least I had endeavored to make some return for the many trout I had captured, and the glorious sport I had experienced during ten years at Rangeley. The expenses were under $25.

Ten years have elapsed since the first black bass were deposited in Maine waters. Now mark the results.

I hold in my hand a letter from Mr. Henry O. Stanley, for

several years Commissioner of Fisheries of Maine, dated Dixfield, Maine, March 15th, 1880. In answer to my queries he writes:

The stocking of Maine waters with black bass, for the first time, by yourself, in 1869, has proved a great success. There are probably fifty ponds in the state that furnish good bass fishing, and many more where they are just beginning to be taken. I have found small bass quite abundant the third year from the time a dozen large ones were deposited.

With regard to their effect on pickerel: in every instance the latter have decreased, leaving the former masters of the situation, with a decided improvement upon the morals of the other denizens of the domain. We do not introduce them in waters frequented by trout, although I do not think they would be as disastrous as pickerel in destroying the trout.

The domestic qualities of the bass are admirable, and might well be taken as an example by some members of the human family. They always look after their little ones, and woe to any pickerel in a sucker's clothing that loiters around the family rocks.

Long may he live in Maine waters, that is, if he retains his present commendable characteristics, and he does not undertake to count out the salmon and the trout, as some human gar-fish and suckers in Maine have undertaken to—to—to—well—well—I'm hooked on to another line of thought. Please pardon me, and believe me,

Ever gratefully yours,

HENRY O. STANLEY.

GEO. SHEPARD PAGE,
Stanley, N. J., March 29th, 1880.

MR. ANNIN then exhibited the model of an outlet for a pond, and made the following remarks:

The great objection made by many persons desiring trout in their private pond or brook (when all other points are satisfactorily settled) is, that if they put in the small-fry they are afraid they will never see any good results; that the fry will all be

washed away or devoured by the larger fish, or unless fed they will starve.

Questions on this point, answered by fish-culturists in the majority of cases, seem to give but very little satisfaction to the inquirer, for by a word, after you supposed that matter all settled, you will see he is troubled about it yet.

For the benefit of all such I would say, if you have put fry into your brook, don't worry; go to bed and rest, feeling you have done your part. Rest assured that nature and their natural instincts will bring them through all right.

In ninety-nine cases out of a hundred the young fry turned loose in stream or pond, and allowed to take care of themselves, will bring forth at the end of the year a much larger per cent. and better fish in every respect than can be produced by confinement and artificial food.

I have found that the male trout, after three or four years of confinement, becomes almost barren; that is, the yearly supply of milt becomes very limited. One good wild-trout will impregnate more eggs than a half dozen domesticated ones.

In a liquid form, resembling milk (see male and female specimens).

Information is often asked as to which is the best kind of a screen for the outlet of a pond.

I have been troubled very seriously in the fall and early winter with leaves, etc., floating down against the screens and choking them up, causing an overflow of the pond.

The trouble is not so much in the day time, when we can watch the ponds, but during a windy night, after the ground is covered with leaves; in the morning you will often find your pond full and running over, and if it contains yearling fish, or smaller, you will find many have escaped or lay on the bank dead.

I had suffered in this way several times, when I thought some plan might be hit upon so that the difficulty would be remedied, and so made something like the model, which you will see will not allow the surface-water or leaves on the surface to clog the outlet during one night or more. After putting this in use the

trouble was done away with at once. I have seen the same principle in use before.

MR. GEO. CHAPPELL then brought forward the subject of the protection of lobsters.

A letter was read from MR. MIDDLETON, which was as follows:

NEW YORK, March 31st, 1880.

MR. GEO. CHAPPELL:

DEAR SIR—As a member of the Association now in session, I would request you to lay the enclosed copy of the Massachusetts lobster law before it for consideration.

It would seem only necessary to refer to the gradual destruction of lobsters to have the subject receive the earnest attention to which its importance entitles it. The law, if enacted, can work no hardship to the citizens of New York, and will only be in harmony with the laws of the states of Massachusetts and Maine, and prevent the selling in our markets a poor article, which is really contraband, having been caught in violation of law.

Hoping this will receive your attention, and meet the views of dealers generally,

I am yours, etc.,

GEO. W. MIDDLETON.

AN ACT,

PROVIDING FOR THE PRESERVATION OF LOBSTERS.

Be it enacted by the Senate and Assembly, in Legislature assembled, and by the authority of the same, as follows:

§ 1. Whoever sells, or offers for sale, or has in his or her possession, with intent to sell, either directly or indirectly, any lobsters less than ten and one-half inches (10 1-2) in length, measuring from one extreme of the body to the other, exclusive of claws or feelers, shall for every such lobster be fined five dollars (should be $10).

§ 2. All forfeitures accruing under this act shall be paid, one-half to the person making the complaint, and one-half to the city or town where the offence is committed.

§ 3. This act shall take effect on the first day of May, 1880.

The views of MR. J. M. JOHNSON, of Boston, who has paid attention to this subject for a number of years, was then cited.

By a vote of the Association the Executive Committee were called upon to see that a law be passed in New York to limit the size of the lobsters sent into the market to ten and a half inches.

MR. PAGE made a motion that the Committee present the bill to the Legislature at once, which was carried.

A vote of thanks was then offered to the Fulton Market Fishmongers Association for the use of their room.

The meeting then adjourned to next year, the date to be fixed at some future period by the Executive Committee.

CONSTITUTION.

ARTICLE I.—Name and Objects.

The name of this Society shall be "The American Fish Cultural Association." Its objects shall be to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success; the interchange of friendly feeling and intercourse among the members of the Association; the uniting and encouraging of the individual interests of Fish Culturists, and the treating of all questions regrading fish, of a scientific and economic character.

ARTICLE II.—Members.

Any person shall upon a two-thirds vote of the Society, and a payment of three dollars, be considered a member of the Association, after signing the Constitution. The annual dues shall be $3.00.

ARTICLE III.—Officers.

The officers of the Association shall be a President, a Vice-President, a Corresponding Secretary, a Recording Secretary, a Treasurer, and an Executive Committee of seven members, and shall be elected annually by a majority of votes; vacancies occurring during the year may be filled by the President.

ARTICLE IV.—Meetings.

The regular meetings of the Association shall be held once a year, the time and place being decided upon at the previous meeting.

ARTICLE V.—Changing the Constitution.

The Constitution of the Society may be amended, altered, or repealed, by a two-thirds vote of the members present at any regular meeting.

TREASURER'S REPORT.

DR. *American Fish Cultural Association in account with Eugene G. Blackford.* CR.

1879.					
	To balance as per last report,	$232 25	By membership dues collected, - -		$198 00
Feb. 28th,	To stationery at meeting, -	65	Balance due Treasurer, - - -		131 70
March 5th,	To messenger, - - -	1 00			
" 7th,	To printing invitation circular,	4 50			
	To printing report of meeting,	90 45			
	To wrappers, - - -	85			
		$329 70			$329 70

New York, March 30th, 1880.

MEMBERS

OF THE

American Fish Cultural Association.

Ambler, Andrew S., Danbury, Conn.
Andariese, C. H., Bedford Avenue, Brooklyn, N. Y.
Andersen, E. J., Trenton, N. J.
Anderson, A. A., Bloomsbury, N. J.
Annin, James, Jr., Caledonia, N. Y.
Baird, Spencer F., U. S. Commissioner of Fish and Fisheries, Washington, D. C.
Benjamin, Pulaski, Fulton Market, New York.
Benkard, James, Union Club, New York.
Betteman, C. G., Bergen Opzoon, Holland.
Blackford, E. G., Fulton Market, New York City.
Boardman, H. G.
Boyer, B. Frank, Reading, Pa.
Bradley, Richards, Brattleboro, Vt.
Belmont, Perry, 19 Nassau Street, New York.
Bogert, Harris, Central Market, New York.
Breese, W. L., Union Club, New York.
Brewer, J. D., Muncey, Pa.
Bridgman, J. D., Bellows Falls, Vt.
Brush, G. H., Norwalk, Conn.
Burges, Arnold, West Meriden, Conn.
Bush, John T., Niagara Falls, Canada.
Campbell, Anthony, Brooklyn, N. Y.
Carey, H. T., 29 New Street, New York.
Carman, G., Fulton Market, New York.
Chandler, F. J., Alstead, N. H.
Chappel, George, Fulton Market, New York.
Chase, Oren M., Detroit, Michigan.
Bowles, B. F. Springfield, Mass.
Bickmore, Albert S. Central Park, N.Y. city.

Chrysler, Gifford W., Kinderhook, N. Y.
Clapham, Thomas, Roslyn, L. I.
Clapp, A. T., Sunbury, Pa.
Clift, William, Mystic Bridge, Conn.
Colburn, Charles S., Pittsfield, Vt.
Collins, A. S., Caledonia, N. Y.
Comstock, Oscar, Fulton Market, New York.
Conklin, William A., Central Park, New York.
Conselyea, Andrew, Springfield, Long Island, N. Y.
Coup, W. C., New York City.
Crocker, A. B., Norway, Maine.
Crosby, Henry F., 18 Cliff Street, New York.
Cox, Townsend, 50 Exchange Place, New York.
Develin, John E., 155 Broadway, New York.
Dieckerman, George H., New Hampton, N. H.
Dwight, H. P., Toronto, Ontario.
Edmunds, M. C., Weston, Vt.
Evarts, Charles B., Windsor, Vt.
Farnham, C. H., Milton, N. Y.
Farrar, Benjamin, St. Louis, Mo.
Fearing, C. I., 30 Broad Street, New York.
Ferguson, T. B., Baltimore, Md.
Feuardent, G. L., 30 Lafayette Place, New York.
Foord, John, *New York Times*, New York.
Fliess, W. M., 47 Broadway, New York.
French, Asa B., South Braintree, Mass.
Gilbert, E., 273 Pearl Street, New York.
Gill, Theodore, Washington, D. C.
Goode, G. Browne, Washington, D. C.
Gray, H. W., Union Club, New York.
Green, Seth, Rochester, N. Y.
Hall, G. W., 16 West 24th Street, New York.
Hallock, Charles, New York City.
Haley, Albert, Fulton Market, New York.
Haley, Caleb, Fulton Market, New York.
Habershaw, William M., 159 Front Street, New York.
Habershaw, Frederick, 6 West 48th Street, New York.
Harris, J. N., Fulton Market, New York.
Harris, W. C., 50 North 7th Street, Philadelphia.
Hessel, Rudolph, Washington, D. C.
Hewitt, C. L., Holidaysburg, Pa.
Heywood, Levi, Gardner, Mass.

Hilmers, H. C., 63 Wall Street, New York.
Holberton, W., 65 Fulton Street, New York.
Holley, W. P., Katonah, N. Y.
Hopson, W. B., *Sea World*, New Haven, Conn.
Hollins, H. B., Union Club, New York.
Hooper, H. H., Charleston, N. H.
Hudson, William M., Hartford, Conn.
Hunt, J. Daggett, Summit, N. J.
Hunt, N. W., 70 Lee Avenue, Williamsburgh, L. I.
Hunt, Luther B.
Huntington, Dr., Watertown, N. Y.
Hutchinson, Charles, Utica, N. Y.
Janney, J. L., Newton, Bucks County, Pa.
Jerome, George H., Niles, Michigan.
Jewett, George, Fitchburg, Mass.
Johnson, S. M., Warren Bridge, N. Y.
Jones, Gilbert E., *New York Times* office, New York.
Kelley, P., 346 Sixth Avenue, New York,
Kent, Alexander, Baltimore, Md.
Kingsbury, Dr. C. A., 1119 Walnut Street, Philadelphia.
Kimball, Robert J., 4 Exchange Court, New York.
King, O, K., Union Club, New York.
Laird, James H., 252 Sixth Avenue, New York.
Lamberton, Alexander B., Rochester, N. Y.
Lamphear, George, Fulton Market, New York,
Lawrence, G. N., 45 East 21st Street, N. Y.
Lawrence, F. C., Union Club, New York.
Lawrence, Alfred N., 172 Pearl Street, New York,
Lawrence, A. G., Union Club, New York,
Ledyard, L. W., Cazenovia, N. Y.
Lees, Edward M., Westport, Conn,
Leeds, Theodore E., 102 Broadway, New York,
Lewis, C. A., Washington Market, New York.
Lowrey, G. P., Tarrytown, N. Y.
Lowrey, J. A., Union Club, New York.
Lyman, Theodore, Brookline, Mass.
Maginnis, Arthur, Stanhope, Pa.
Malcomson, A. Bell, Jr., New York City.
Mann, J. F., Lewiston, Pa.
Mather, Frederick, Newark, N. J.
Mathews, W. C., Toronto, Ontario.

Mallory, Charles, foot Burling Slip, New York.
McGovern, H. D., Brooklyn, N. Y.
Middleton, W., Fulton Market, New York.
Miller, S. B., Fulton Market, New York.
Miller, Ernest, Fulton Market, New York.
Milner, James W., Washington, D. C.
Morford, Theodore, Newton, N. J.
Morgan, John B., 85 Broadway, Brooklyn, N. Y.
Mull, B. E., Fulton Market, New York.
Mullaly, John, 114 White Street, New York.
Munn, H. N., Union Club, New York.
Neidlinger, Phil., 27 Beekman St., New York City.
Newell, W. H., San Francisco, Cal.
Nicholas, N. J., Union Club, New York.
Page, George S., 10 Warren St., New York City.
Parker, Wilbur F., Meriden, Conn.
Paxton, E. B., Detroit, Mich.
Phillips, B., 41 Troy Ave., Brooklyn, N. Y.
Porter, B. B., Colorado.
Post, W., Knickerbocker Club, New York.
Price, Rodman M., Ramsey, New Jersey.
Raynor, William P., 115 William Street, New York.
Redding, B. B., San Francisco, Cal.
Redding, George H., Stamford, Conn.
Redmond, R., 113 Franklin Street, New York.
Reeder, H. J., Easton, Pa.
Reinecke, Theodore, Box 1651, New York.
Reynal, J., 84 White Street, New York.
Reynolds, J. B., *Forest and Stream*, New York.
Richmond, W. H., Scranton, Pa.
Ricardo, George, 195 Water Street, New York.
Roach, John C., Brooklyn, New York.
Robinson, R. E.
Rockford, A. P., Salt Lake City, Utah.
Rogers, A. L., Fulton Market, New York.
Rogers, H. M., Fulton Market, New York.
Roosevelt, Hon. Robert B., 76 Chambers Street, N.Y.
Rupe, A. C., New York.
Saltus, Nicholas, New York City.
Sherman, R. U., New Hartford, Oneida Co., N. Y.
Shultz, Theodore, New York City.
Simonton, J. W., 195 Broadway, New York.

Smith, Greene, Peterboro, Va.
Sprout, A. B., Muncey, Pa.
Steers, Henry, 10 East 38th Street, New York.
Sterling, Dr. E., Cleveland, Ohio.
Stetson, J. A., Cleveland, Ohio.
Stewart, T. B., 23rd Street and Sixth Avenue, N.Y.
Stillwell, E. M., Bangor, Maine.
Stone, Livingston, Charlestown, N.H.
Stone, Summer R., 46 Exchange Place, New York.
Stoughton, E. W., Windsor, Vt.
Stuart, Robert L., 154 5th Avenue, New York.
Swartz, William H., Point Pleasant, Bucks Co., Pa.
Tagg, Henry, Philadelphia, Pa.
Townsend, Isaac, Union Club, New York.
Townsend, Thomas D., Toronto, Ontario.
Thomas, H. H., Randolph, N. Y.
Thompson, H. H., 12 East 46th Street, New York.
Thompson, John H., New Bedford, Mass.
Thompson, J. S. W., 31 Pearl Street, New York.
Trimble, Dr. J. P., 221 East 12th Street, New York,
Van Brunt, C., 121 Chambers Street, New York.
Van Cleve, Joseph, Newark, N. J.
Van Siclen, G. W., 99 Nassau Street, New York.
Van Wyck, J. T., New York City.
Ward, George E., 43 South St., New York City.
Weber, Samuel, Manchester, N. H.
Weeks, Seth, Corry, Erie Co., Pa.
West, Benjamin, New York City.
Whitcher, W. F., Ottawa, Ontario, Canada.
Whitcomb, T., Springfield, Vt.
Whitehead, C. E., 61 Wall Street, New York.
Whitin, Edward, Whitinsville, Mass.
Wilbur, E. R., 40 Fulton St., New York.
Wilmot, Samuel, Newcastle, Ontario, Canada.
Willets, J. C., Skeaneatles, N. Y.
Woods, Israel, Fulton Market, New York.
Worrall, James, Harrisburg, Pa.
Wiman, Erastus, 312 Broadway, New York.
Whipple, John, Union Club, New York.
Wharton, W. F., Union Club, New York.
Worthington, H. R., 239 Broadway, New York.
Yarrow, Dr. H. C., U. S. A., Washington D. C.
Tileston, W. M. New York.
Chrysler M. H. Kimberhook, Mo.
Rockwood, A. P. Salt Lake City, Utah.
Slack, J. H. Bloomsburg Pa.

(While this report was going through the press, the Executive Committee, as instructed by the Association, lost no time in presenting an act limiting the size of the Lobsters, the same as printed in this report, to the attention of the Legislature at Albany. The Executive Committee take great pleasure in announcing that this act limiting the size of the Lobster, has since June 1st, become a law of the State of New York.)

May 31st, 1880.